Enciclopedia en Español de Maquinaria para Minas, Pagina 56

AUG 28 1916
UNIV. OF

Engineering and Mining Journal

Volume 102, No. 9
Issued Every Saturday
Hill Publishing Company

NEW YORK, AUGUST 26, 1916

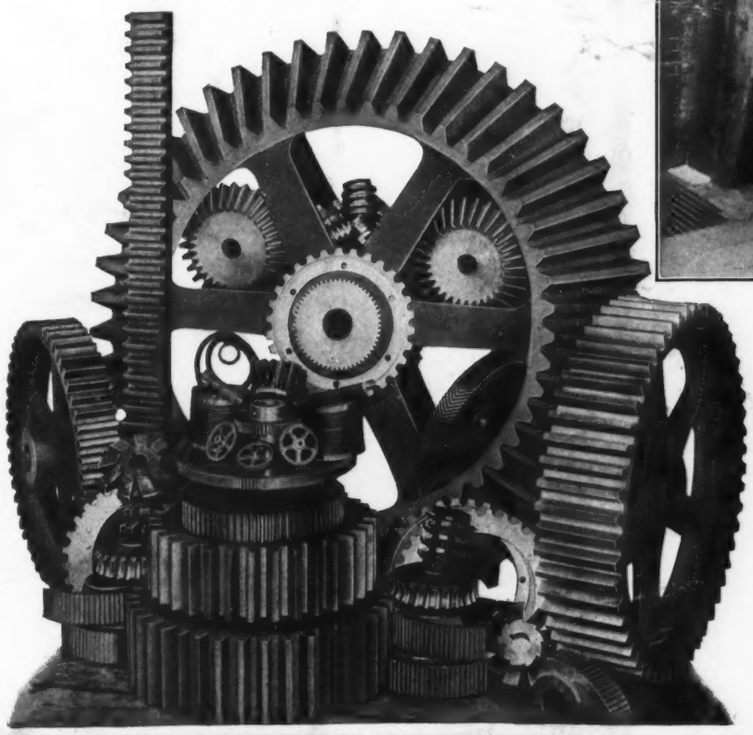
Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

SPEED IN SHIPMENT

When you want gears in a hurry YOU WANT 'EM. Excuses for lateness in shipment don't go. You want THE GOODS, not apologies.

Here's where we fit. Our plant is keyed up to filling and shipping orders on a clock-work schedule that admits of no delay. When we promise to ship your order on a certain date it's as good as delivered, as far as any anxiety on your part is concerned—a big load off your mind in the case of a break-down job.

Naturally this sort of service has made us lots of friends. People used to disappointments in getting their orders shipped quickly are quick to appreciate and use the speedy, dependable service we render.



Gears of All Kinds

and for every kind of service; spur gears, bevel gears, mitre, worm, spiral and helical gears or sprockets—in stock ready for loading on the truck, or capable of being made according to special requirements in record time.

No matter where you are or what you want we'll set our well oiled system in motion the instant we receive your order. And remember—you can always depend upon us not only to use the utmost speed but also to keep our word.

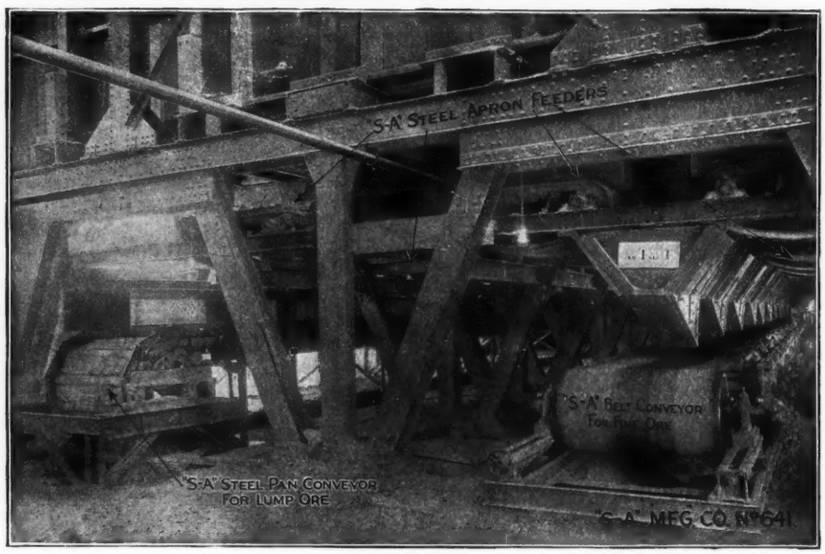
Philadelphia GEAR Works

Vine St. and Reading R. R.
Philadelphia, Pa.

The S-A Page

Published Weekly in the Interests of S-A Conveying Engineering

1,000 Tons of ½-in. to 18-in. Lumps Per Hour



Must be uniformly fed to the conveyors here illustrated — no mean task, particularly when you consider that efficient and economical conveying depends largely upon uniformity of feed.

The "S-A" Apron Feeders shown have handled this heavy lump load with the greatest success — maintaining a steady, non-fluctuating feed that gives the conveyors longer life due to the fact that they continually carry an exactly correct load.

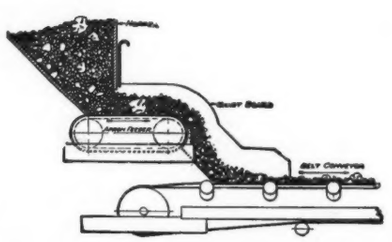
Over one hundred feeders are used in this plant—overcoming the loss of storage capacity due to packed bins, by completely emptying them and preventing all overloading and intermittent service. A preliminary estimate of what "S-A" methods will save for you imposes no obligation.

Write.

Stephens-Adamson Mfg. Company

Conveying, Screening, Transmission Machinery

Aurora - Illinois



Branch Offices:

50 Church St., NEW YORK
First National Bank Bldg., CHICAGO.
79 Milk St., BOSTON, MASS.
H. W. Oliver Building, PITTSBURGH.
803 Federal Reserve Bank Bldg., ST. LOUIS, MO.
1st Nat. Bank Bldg., HUNTINGTON, W. VA.
824 Dime Bank Bldg., DETROIT, MICH.
310 Stair Bldg., TORONTO, CAN.
503 Dooly Block, SALT LAKE CITY.
430 Central Bldg., LOS ANGELES.
Australian Agent—Arthur Leplastrier & Co., Circular Quay East, SYDNEY.
South African Agent—J. Mac G. Love & Co. Ltd., 1 and 3 London House, Loveday St. JOHANNESBURG.
Scandinavian Agent, KRISTIANIA, NORWAY.

Engineering and Mining Journal

VOLUME 102 AUGUST 26, 1916 NUMBER 9

Mining Practice at Santa Gertrudis, Mexico*

SYNOPSIS—Geological report of five years ago substantiated by subsequent findings. Remining of filled stopes has proved profitable, but cost is greater than that of mining virgin ore. Purchased electric power used entirely. Safety-first campaign reduces accidents, which, on account of type of labor employed, had been higher than in American operations.

The properties of the Santa Gertrudis Co., Ltd., lie within the Pachuca district, Hidalgo, Mexico, connected by three railway lines with Mexico City, 55 mi. southwest, and by two lines with Vera Cruz, 250 mi. southeast. The ores were formerly divided by sorting into two classes, smelting and milling, the former averaging about 2 oz. gold and 335 oz. silver, the latter 0.12 oz. gold and 23 oz. silver. The smelting ores were sold to custom plants, principally the American Smelting and Refining Co.'s smeltery at Aguascalientes. The milling ores were treated by the patio process at the Guadalupe hacienda, Pachuca. This patio was probably the largest in existence at the time and continued in active operation up to March, 1910.

In January, 1910, the mines and patio were sold to English interests represented by Camp Bird, Ltd. Two new companies were formed, the Compania de Santa Gertrudis, S. A., to operate the mines, and the Compania Beneficiadora de Pachuca, S. A., to build and operate a custom cyanide milling plant.

The historical geology of the Pachuca district is described by Fred. J. Pope, as follows:

1. The most recent sedimentary rocks in the district belong to the Cretaceous period.

2. The Cretaceous rocks were penetrated by large intrusions of andesite (referred to hereafter as primary andesite) which occur as elliptical dome-shaped masses, striking northwest-southeast. These andesite bodies are from 8 to 15 mi. long and from 6 to 10 mi. wide.

3. A period of erosion during which the contour of the andesite domes was changed.

4. Andesite flows (secondary andesite) which rest unconformably on the primary andesites.

5. A second period of erosion, again exposing areas of primary andesites.

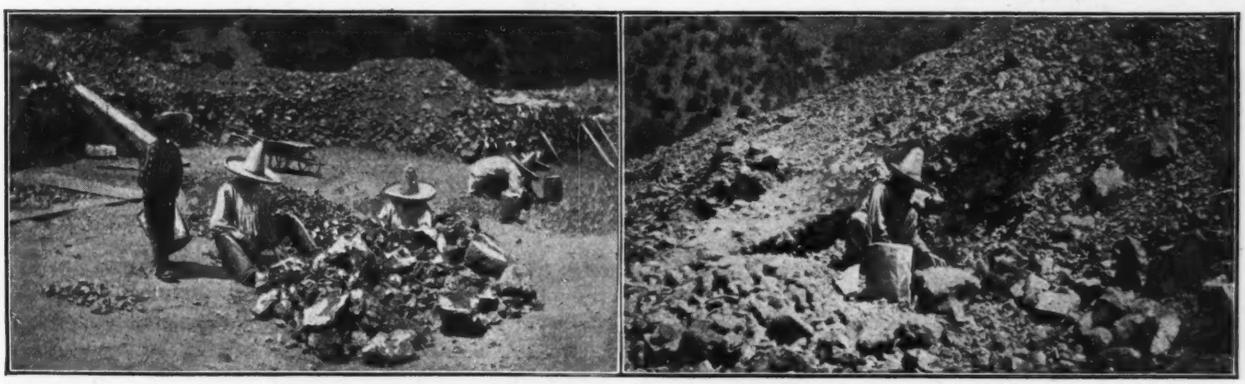
6. A series of rhyolite flows which partly covered the primary and secondary andesites.

7. A third period of erosion which exposed large areas of both the primary and the secondary andesite. During this period there were many intrusions of quartz-porphyry dikes which cut the primary and secondary andesites and the rhyolite. For the most part they do not affect the economic tenor of the veins. In occasional instances, however, the veins are locally impoverished where they cut these dikes. Relative to the extent of the orebodies, these dikes are very small and have no economic value.

8. A period of areal faulting, probably due to subsidence and adjustment caused by the large, dome-shaped masses of primary andesite cooling at depth. During this period fissures were formed, rock between the walls was brecciated and there was a heavy silicification, but practically no economic values were brought into the veins. It was essentially a period of fissuring, brecciation and silicification.

9. A second period of faulting with movements relatively much less than during the first period. It was during and immediately subsequent to this secondary faulting that the veins received their economic values.

10. Erosion and minor faults.



ORE-SORTING METHODS OF A FORMER AGE AT MEXICAN MINES

*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

In discussing the magnetic variations of the primary andesite, Mr. Pope further states:

The primary andesite in which the Santa Gertrudis vein occurs is not a homogeneous rock. There are local variations due to differentiation in cooling. For the most part the andesite has a slight grayish-green color, is porphyritic and breaks with a rough surface. This is the prevailing normal type and averages approximately 65% silica. A more basic variation averages a little over 60% silica, is porphyritic, dark green in color, breaks with a conchoidal fracture and is very tough. Between these two types there are all graduations, and one often graduates imperceptibly into the other. Both occur at all levels to the bottom of the mine, a depth of 2,000 ft.

Operations in the Pachuca district have demonstrated that the tough basic phase of the primary andesite is not favorable to the formation of ore and that all the large orebodies are found in the normal type. This is due to the fact that after the primary faulting and silicification, the basic phase was as tough or tougher than the original rock and thus resisted the secondary fracturing and subsequent introduction of economic values.[1]

The veins are not simple fissures filled with silica and economic minerals, but in a general way may be described as crushed zones varying from a few feet up to 50 and in some instances over 100 ft. in width. Usually both foot and hanging walls are fairly well defined, but in many places the dividing line between ore and wall rock can be determined only by systematic sampling.

As a rule the hanging wall is heavy owing to fracturing and to slips or faults parallel to the vein and in consequence must be carefully supported when mining the ore.

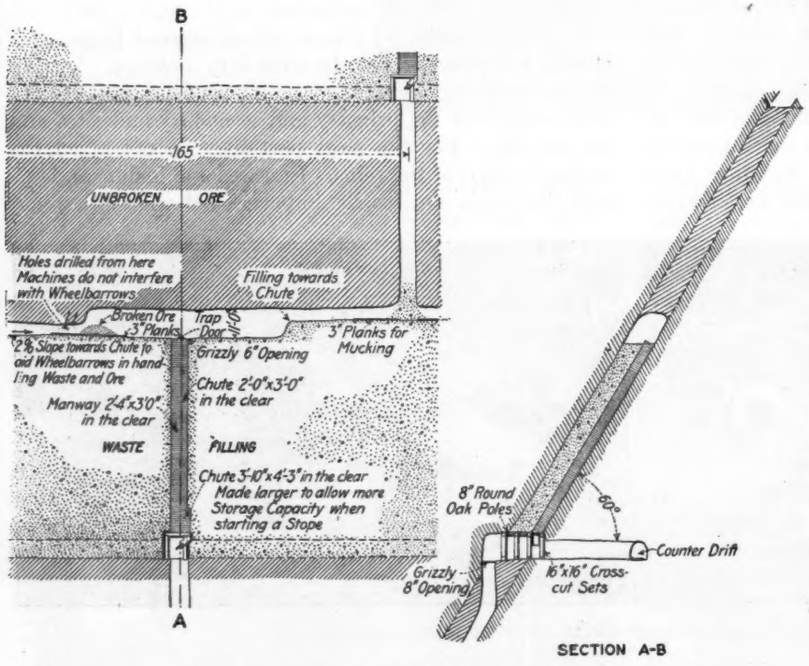


FIG. 1. METHOD OF MINING VIRGIN ORE

The veins of the district are notable for the size and persistence of the oreshoots. As a rule the oreshoots do not outcrop, but are discovered at varying depths of one hundred to several hundred feet from the surface and in the upper levels are shorter and often have a distinctive pitch, generally to the east. Several of these shoots usually combine in depth to form the main great oreshoot of the mine. In the Santa Gertrudis vein a number of the smaller shoots were thus worked to depths of from 800 to 900 ft. At about this horizon they joined together, forming an orebody which persisted for another 600 to 700 ft. in depth, having a length in the several adjoining properties of some 3,000 ft. and a width averaging 18 ft. The grade of this great oreshoot was not less than $20 per ton[2].

At a horizon of about 1,800 ft. from the surface the veins, though still strong, become rapidly impoverished and at 2,000 ft. little payable ore is to be found. Below this horizon explorations are being conducted to discover the possible existence of a new zone of mineralization, but such work is not sufficiently advanced to permit any forecast of results.

The ores generally are clean, carrying very small quantities of lead, zinc or iron and with little or no manganese, none of which has any economic importance. The principal economic mineral is silver sulphide—argentite. The commercial values are confined to gold and silver, which are present in the proportion of 15% and 85% respectively. By weight, for each 1,000 oz. of silver there is usually 5 oz. of gold present.

The mining systems in general use are: (a) Overhead stoping without timbering, with filling; (b) overhead stoping with timbering and filling; (c) overhead stoping with shrinkage, with and without subsequent filling. In mining virgin ore in place system (a) is most generally adopted, being used where the hanging wall is too heavy to employ shrinkage stoping, but sufficiently strong to hold until the stope can be filled. Fig. 1 illustrates the details of this system. Foot-wall drifts (counterdrives) in the harder andesite are kept open after the sill floor of the vein has been stoped out and filled. Crosscuts from the counterdrive are run through the vein every 165 ft. and heavily timbered with chutes for drawing the ore from the stopes. These chutes are carried up with cribbed timbers as the stope advances and are divided into two compartments, one for ore and one for manway. Between each two crosscuts a raise is put up to provide entrance for the waste used in filling. Spreading this waste is done with wheelbarrows. Throughout the Pachuca district the remining of the old areas has become of great importance. The old fills are generally payable, and in most cases ore in place is also found on the walls. At first sight it might appear that such territory would be cheaper to mine than virgin ground. But this is not the case, for both the hanging wall and the ore are heavier, making it necessary to adopt system (b) with resulting slower extraction of ore at higher cost. Fig. 2 illustrates the details of this system, which in the main follow those of system (a) with the addition of square-set timbering. As the timbers are soon covered by the waste filling, light sets of 8x8-in. square

[1]Mr. Pope's report was made after a brief examination undertaken at the time of the purchase of the properties by the Camp Bird interests. Subsequent developments over five years have confirmed his findings in general. Several ore-bearing veins occur in basic andesite areas, but oreshoots are small and of relatively small economic importance. In the main North Vein, wherein the principal oreshoots are located, the lean parts of the vein within the ore-bearing horizon usually occur where the vein passes through the tough basic phase.

[2]United States currency and dry short tons used throughout unless otherwise specified.

or of equivalent round posts are sufficient. Sets measure 7 ft. 5 in. high by 5 ft. in the clear.

System (c) is only applicable in one small stope in the Santa Gertrudis mine and hence need not be discussed in detail. In general it is used more commonly in the Real del Monte district than on the Pachuca side, the walls in the former district being much harder and more secure.

Levels were formerly driven 75 to 100 ft. apart. More recently the distance has been increased to 165 ft. (50 m.) vertically. It is questionable whether a greater distance than this could be used economically because of difficulty of holding open the timbered chutes.

Ore breaking is entirely overhand, using air hammer drills and 7/8-in. 40% gelatin powder. Filling for the stopes formerly obtained from caving stations in the hanging wall is now derived partly from development headings. To provide excess requirements a quarry is being opened on the surface to tap which a central raise in hard foot-wall rock is being put up. This raise will deliver or receive waste at each level.

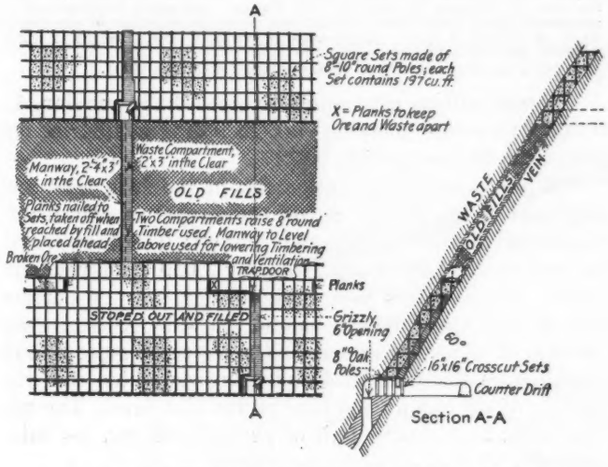

A
Square Sets made of 8-10" round Poles; each Set contains 197 cu. ft.
X = Planks to keep Ore and Waste apart
Waste Compartment, 2'x3' in the Clear
Manway, 2'-4"x3' in the Clear
OLD FILLS
Planks nailed to Sets, taken off when reached by fill and replaced ahead
Two Compartments raise 8' round Timber used. Manway to Level above used for lowering Timbering and Ventilation
Broken Ore
TRAPDOOR
Planks
STOPE IS OUT AND FILLED
Grizzly, 6" Opening
8" Oak Poles
6'0"
16'x16" Crosscut Sets
Counter Drift
WASTE
OLD FILLS
VEIN
A
Section A-A

FIG. 2. METHOD OF REMINING OLD AREAS

Sinking San Francisco No. 2 Shaft

Shaft sinking is generally against considerable water—200 to 400 gal. per min.; 3 1/8-in. machine drills are used. Electric firing of rounds has been tried, but with only partial success, on account of breaking timbers which must be carried close to the bottom. Electric time fuses have been used with better success and when intelligently handled are an improvement upon ordinary fuse firing. Of special interest was the construction of a two-compartment shaft (San Francisco Shaft No. 2) adjacent to the existing three-compartment San Francisco Shaft No. 1. A pillar of rock, 20 ft. wide, was left to protect the latter shaft, which was kept in operation; sinking and raising were carried on coincidently from several different levels. The shaft raises were timbered in two compartments, a light cage being used in the manway to handle men and tools. A small electric hoist at the foot of the raise served the cage, the hoisting rope being carried over a sheave swung from a movable beam at the top of the raise timbers. Sinking was done by usual methods. Work was commenced in March, 1912, and the shaft completed with pockets at a number of levels and put into operation in May, 1913, a distance of 1,768 ft. from the collar to the 19th level. Steel timbering, bought cut to proper lengths but fabricated locally, was installed throughout. No. 18 galvanized corrugated sheet lagging was used where necessary, being slipped into place on the outside of sets and held secure by small steel clips riveted to the sheets and fitted over the flange of the I-beam wall plates. The cost of the shaft without pockets was: Raising and sinking, $24.62 per ft.; timbering (steel), $20.33; loading and tramming, $0.65; hoisting (waste to surface), $6.23; explosives, $2.92; lighting, $0.59; miscellaneous, $0.27; total, $55.61 per foot.

All drifting and crosscutting of importance is done with 3 1/8-in. machine drills, using the horizontal bar mounting, two machines to a bar, the muckers cleaning up the breakage while the top part of the round is being drilled. Raising is entirely accomplished with air hammer drills. Winzing is generally by hand and only a relatively small amount of it is done, raising being generally cheaper and more rapid. Air hammer drills are occasionally used in winzing in hard ground.

Development costs per foot average:

	Shaft Sinking (Against Water)	Drifting and Crosscutting	Raising	Winzing
Labor	$59.25	$3.75	$2.50	$4.75
Timber	8.45	.10	.35	.10
Explosives	3.25	1.70	.70	.60
Lighting	.70	.05	.06	.06
Tracking and piping	1.00	.60	.12	....
Power	15.60	.50	.50	.55
Maintenance, machine drills	.50	.05	.10	....
Tools	.45	.10	.10	.10
Tool sharpening	1.50	.60	.60	.10
Hose, pump fittings, etc.	1.50	.05	.05	....
Lubricants	.25	.02	.02	....
Supervision	1.05	.30	.30	.30
Totals	$93.50	$7.82	$5.40	$6.56

Tramming underground is by hand and electric haulage. Four main levels are equipped with electric haulage using 2.5-ton Jeffrey trolley locomotives, 250 volts. A battery locomotive was tried without success, the equipment being insufficient to handle the load against varying grades and track curvatures. In the locomotive haulage, a train is made up of ten U-dump cars each of 20 cu.ft. capacity, equal to about 0.9 of a dry ton of Santa Gertrudis broken ore. The cars are equipped with Whitney roller-bearing wheels and in general are giving good satisfaction. The center of gravity is sufficiently low to require complete filling for easy dumping, allowing the cars to be emptied over the shaft pockets without stopping the train. Waste for stope filling is loaded into the empty cars from the waste chutes on the return trip, when required. On hand-tramming levels the ore is passed, wherever possible, to electric haulage levels for transportation to shafts. Tracks are 20-in. gage, 16- and 20-lb. rails.

Men and material are handled in San Francisco Shaft No. 1; two double-deck cages operating in and out of balance and served by an Allis-Chalmers double-reduction geared electric hoist, using three-phase 50-cycle 440-volt 300-hp. induction motor with grid-type resistance, rope speed 1,000 ft. per min.; also in San Juan shaft, two single-deck cages operating in balance and served by a converted 150-hp. electric hoist, rope speed 700 ft. per min.

Ore and waste are handled in San Francisco Shaft No. 2, two 5-ton skips operating in or out of balance and served by a Fraser & Chalmers single-reduction herringbone-geared hoist using three-phase 50-cycle 440-volt 350-hp. induction motor with liquid-controller type resistance, rope speed 1,000 ft. per min., capacity 800 tons per 8-hr.

shift; also in San Guillermo shaft, one 3.5-ton skip operating counterbalanced and served by a duplicate of the hoist used on San Francisco No. 1; rope speed 1,000 ft. per min., capacity 200 tons per 8-hr. shift. This compound shaft is of interest because of its unusual characteristics. It is of old-style masonry from collar to 9th level; heavily timbered through the vein to the 13th level, has a twist of 30 deg. between the 13th and 15th levels to bring it parallel to the vein; between the 15th and 16th levels is a 50-ft. radius compound to convert the shaft to 60-deg. incline at which it continues to the 20th level, a total vertical and inclined length of 2,090 ft. Except for the heavy part through the vein, but little trouble has been experienced in the operation of this shaft, despite its small size in the upper section.

Plough-steel ropes of flattened-strand construction are used for hoisting, 1 in. diameter on men and materials

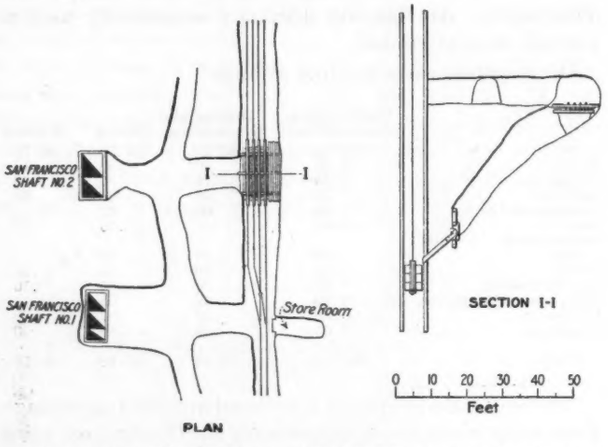


FIG. 3. ARRANGEMENT OF POCKETS AT LOADING LEVELS

hoists and 1⅛ in. diameter on the ore hoists. Ropes are systematically inspected, as per South African requirements. After two years' service new ropes are put on, even though the old ones show no undue wear.

On all working levels there are pockets serving the skips. Fig. 3 shows characteristic arrangement of the grizzly on top of the pocket and the tracking layout. Because the ore is free running and unusually fine, no measuring chutes are required, skip loading being accomplished accurately and with minimum loss of time by manipulation of the gates. With ample ore supply—that is, pocket fairly full—the loading time is from 15 to 20 sec.

The main pump station (Fig. 4) is on the 18th level near the San Guillermo shaft. The 10-in. discharge column of Mannesman drawn-steel tubing with bolted forged-steel flanges and round copper gaskets is carried horizontally on concrete pillars to the San Francisco Shaft No. 1 and thence vertically to the tunnel level, a total length of 2,067 ft. and a vertical lift of 1,328 ft. The equipment of the station consists of three 500-gal.-per-min. horizontal-duplex double-acting Prescott high-duty pumps, each driven through one reduction of herringbone steel gearing by a three-phase 50-cycle 1,040-volt 250-hp. General Electric induction motor, 480 r.p.m. No water-hammer difficulties have developed during three years' service, and the equipment in general has given excellent satisfaction. A traveling crane made the installation easy and assists materially in repair work. The pumps were installed under a guarantee of 85% efficiency based on power delivered to motor pinion. The motor efficiency was measured at the factory. A series of tests made by the local staff, after the pumps had been in operation for over a year, gave the following results:

No. of Pump	Water Pumped, Gal. per Min.	Static Head, Ft.	Static Head, Lb.	Dynamic Head, Ft.	Dynamic Head, Lb.	Theoretical Water Hp.	Input to Motor Hp.	Motor Efficiency From Curve	Input to Pump Hp.	Pump Efficiency, Sump to Discharge	Combined Pump and Motor Efficiency
1	480	1,328	573	1,371	591	160	193	93.1	180	89.2	83.0
2	481	1,328	573	1,371	591	161	199	93.1	186	86.6	80.7
3	469	1,328	573	1,371	591	157	192	93.1	179	88.9	81.6
1 & 2	950	1,328	573	1,388	599	317	408	93.1	380	83.6	77.8
1 & 3	940	1,328	573	1,388	599	314	400	93.1	372	84.4	78.5
2 & 3	939	1,328	573	1,388	599	314	403	93.1	375	83.6	77.8
1, 2 & 3	1,421	1,328	573	1,418	612	475	650	93.1	605	78.4	73.0

R.p.m. of motor, 480; hp. of motor, 250; voltage of motor, 1,040; r.p.m. of pump, 49.6; length of stroke, 3 ft.; original diameter of plunger, 4¼ in.; diameter of plungers at time of test, $4\frac{3}{16}$ in.; calculated displacement of plungers at 4¼-in. diam., 519.4 g.p.m.; calculated displacement of plungers at $4\frac{3}{16}$-in. diam., 505.5 g.p.m.: temperature of water, 87 deg.; weight of water, 8.304 lb. per U.S. gal.

In pump 3, after tests, a small stick was found under one valve.

Average gallons per minute pumped, 815; per day, 1,173,600; average pumping cost, including auxiliaries per day, $208.24; per gallon, 0.0177c.

The old main pump station was at the 15th level and consisted of two 8-stage Sulzer centrifugal pumps direct-connected to 480-hp. induction motors of German make, no load speed, 1,200 r.p.m., capacity 3,600 liters per min. each. These motors were designed for 60-cycle current and at 50 cycles failed to handle the water satisfactorily because of reduction in speed. One of these units is now installed on the 18th level and being connected into the suction of the pump remaining on the 15th level. The two now serve as a reserve unit of about 1,000 gal. per min. capacity.

Water from the 20th level is pumped to the 18th level by a 1,000-gal.-per-min. Alberger centrifugal pump, electrically driven. In shaft sinking below the 20th level No. 10 Cameron sinking pumps are used with air at 80 lb. pressure, and as the lift becomes too great for the air pumps, electric centrifugal station relay pumps are installed.

The natural ventilation of the mine is good, owing to the many shaft connections and to communications with the eastern adjoining properties, Barron and La Blanca. A motor-driven Sirocco fan is occasionally used temporarily to ventilate some section pending the completion of connections for natural air currents.

Particular attention is paid to keeping all parts of the mine free from refuse or filth. Special sanitary buckets are provided in suitable places on each level, which the men are required to use and are systematically taken to the surface for cleansing, lime being applied liberally underground to limit odors.

The main levels where there is much traffic are sprinkled with water daily, from a small truck fitted with a barrel having an ordinary sprinkler attachment. Good drinking water is piped to each shaft station. A well ventilated and heated change room is provided, equipped with shower baths of hot and cold water. This facility is not ordinarily found at a mine in Mexico, but its use is to be encouraged.

Within the last two years an active safety-first campaign has been in hand with very gratifying results. As is well known to all operators in Mexico, the native labor is unusually careless of danger or ordinary precautions

against accident. Hence the problem presents exceptional difficulties and requires all the more careful attention to preventive details. Because of the reckless irresponsibility of the individual, coupled with a callousness to accidents which in fairness must be charged to the operators as well as to the men, the accident rate in Mexican mines is abnormally high. And for the reasons stated, this rate will always compare unfavorably with those of well-regulated mines in the United States or Europe. Nevertheless, a great deal can be done to improve this condition.

After securing information from some of the leading American mining companies experienced in safety-first measures, similar steps were undertaken here. A book of instructions covering accident prevention and first-aid measures was issued in Spanish and English. The shift bosses, or "capitanes," of each mine section were made directly responsible for accidents, careful statistics being kept of the work of each boss, with a monthly premium of money to the one having the best record for the month and a gold watch with suitably engraved inscription for the best record for six months. An annual contest is held in which various crews compete in rescue and first-aid measures. Bosses and men are drilled in the use of oxygen helmets. A monthly bulletin is printed in Spanish and distributed among the men, in line with similar bulletins issued by American companies.

As of interest to other operators in Mexico, some of the mechanical measures undertaken will be described briefly. All shaft entrances are provided with self-closing gates. After trying out several types, the one selected as most simple and efficient is merely swung off center and closes by gravity without undue jar. The upper gate is similarly swung, to protect the individual from falling rocks while standing at the shaft. Many accidents in Mexican mines are from men carelessly stepping into open chutes or manways in stopes or levels. All chuteways throughout the mine are now covered with rail grizzlies; manways either have a trapdoor of light corrugated iron or, where this interferes with ventilation, the timber is carried up sufficiently so that the top can be covered, leaving an opening at one end or on the footside for passageway. This opening is kept small enough so that a man cannot slip into it inadvertently. All manway openings on levels have in addition a warning red electric light.

Explosives to be used currently are stored underground in suitably placed crosscuts fitted with steel doors set in masonry. Fuse and caps are similarly stored separately. It having been found impossible to prevent the practice of crimping the caps with the teeth, fuse is now issued from these underground stores, cut to desired length and with caps properly crimped on by the storekeeper. The main storage of explosives is situated some distance from the property.

Rock falls are a principal cause of many accidents. As elsewhere, the main preventive is constant vigilance on the part of the bosses combined with such coöperation as it is possible to secure from the men. This spirit of coöperation is obtainable only in a limited amount in Mexico, but continued application will bring it forth to a helpful extent.

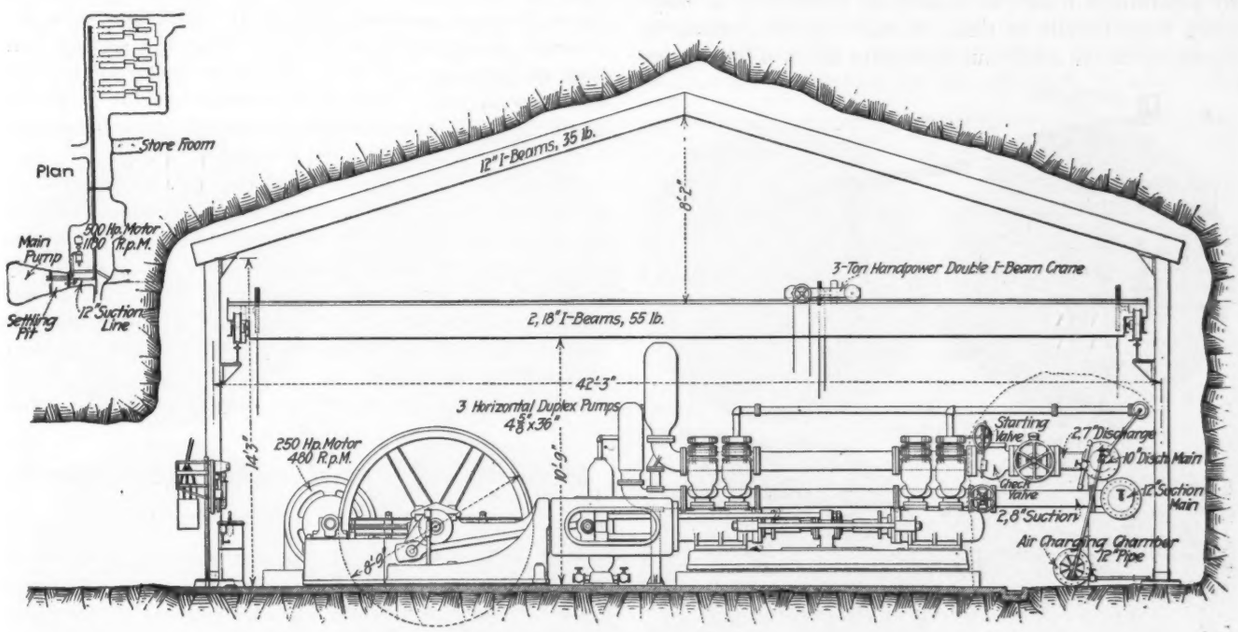


FIG. 4. MAIN PUMP STATION ON 18TH LEVEL

Following are accident statistics before and after safety-first measures were undertaken:

ACCIDENTS PER 10,000 SHIFTS

	Deaths	Requiring Operation	Trivial	Tota
Before	0.574	1.436	12.067	14.277
After	0.334	0.669	8.358	9.361

Trivial accidents include numerous bumps, scratches, slight cuts, etc., which do not incapacitate men from working.

Complete Mining-Cost Records Kept

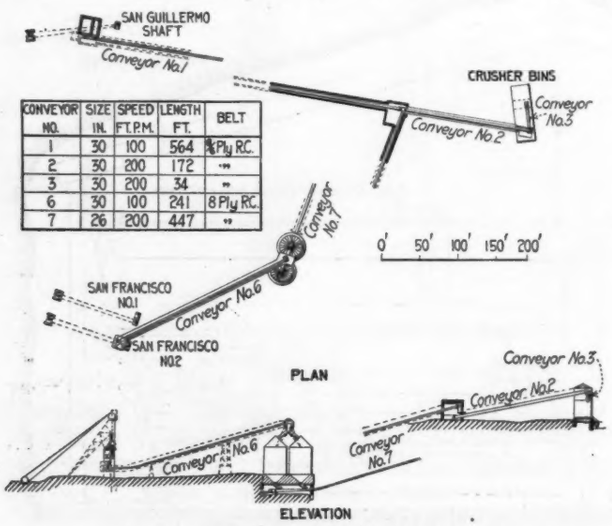
For convenience of comparison and of preserving complete records in compact form, the monthly costs are entered upon a tracing form from which blueprint copies are taken. The system requires perhaps less work than where similarly detailed costs are typewritten, whereas the advantage is obvious over any method that does not permit continuous column comparison of items.

Average costs are given herewith. These do not include recent results which, because of special influences, have

been too low to represent fairly what should be obtainable under normal conditions:

	Per Dry Short Ton
Development	$0.52
Ore breaking	1.47
Mine to mine bins	.24
Drainage	.24
Surface expense	.04
General expense	.27
Total mining cost	$2.77

These results are on the basis of a daily production of 1,000 short tons of ore and may be taken as fairly representative of the Pachuca district. In the adjoining Real del Monte district lower costs are obtainable because the harder walls permit the adoption of the shrinkage system of stoping, with consequent reduction if not elimination of expenditure for square-set timbering and filling. At Santa Gertrudis, for each ton of ore extracted two-thirds of a ton of waste must be supplied and handled for filling and 17 ft. b.m. of timber is used. The shrinkage system affords another important advantage in Mexico by providing a reserve of broken ore which may be drawn upon more heavily at times to make up for current deficiencies due to numerous feast days and a relatively low



CONVEYOR NO.	SIZE IN.	SPEED FT.P.M.	LENGTH FT.	BELT
1	30	100	564	4 Ply R.C.
2	30	200	172	"
3	30	200	34	"
6	30	100	241	8 Ply R.C.
7	26	200	447	"

FIG. 5. SURFACE CONVEYING SYSTEM

constancy of labor. Another important factor affecting local mining costs is the light weight of ore in place and filling ore (old fills). The former averages 13.6 cu.ft. per ton, the latter 17.2 cu.ft. per ton. At Santa Gertrudis the moisture in the ore averages 5% and filling ores represent 65% of the total tonnage mined.

A fair grade of timber is obtainable at $20 per 1,000 ft. b.m. Other supplies, if carefully purchased in quantities, cost about the same as in a mining district in Colorado or Nevada.

Labor efficiency is low, the complicated mining system likewise adversely affecting the duty per man. Including all labor in stopes for drilling, timbering, filling, etc., 1.27 tons of ore per man shift is broken and placed in the chutes; based upon all underground labor, including bosses and foremen, 0.687 ton of ore per man shift is delivered to the surface.

Power is purchased at from $45 to $50 per hp.-year from the Mexican Light and Power Co., whose hydro-electric plant is about 75 mi. away.

All ore is delivered from the mine by self-dumping skips, discharging into surface ore bins. Thence it is transported to the crushing-plant ore bins by means of belt conveyors. Fig. 5 shows in plan the conveying system from the San Francisco No. 2 and San Guillermo shafts to the crusher bins, and also a cross-section of the line from San Francisco Shaft No. 2.

Because of the previously mentioned free-running quality of the ore, plus the unusual percentage of fines which reach the belts first and form a cushion or bed for the larger rocks, the system operates with minimum wear or trouble. Hand-operated sector gates are used throughout, the chutes lips being hinged and counter-weighted to swing up from the belt when not in use.

On account of remining old fills, a large amount of decayed wood comes up with the ore and is picked off at the belts. Careful sorting tests have proved that waste picking cannot be done at a profit. Under close supervision 3.5% by weight was picked off averaging $0.70 per ton at a cost of $0.30 per ton waste; increasing the waste sorted out to 5% resulted in an increase of value to $1 at a cost of $0.40 per ton waste. The actual cost of passing these grades of material through the mill, less value recovered, is calculated to be lower than the sorting cost plus recoverable value lost. Therefore waste sorting has not been adopted. Sorting high-grade ore for shipment to smeltery, because of small quantity available as against high milling efficiency, is not profitable.

This "mine bins to mill bins" cost has averaged $0.02 per dry short ton. Belt wear is exceedingly low. Belt No. 2 is the only one that has been replaced once against a total of 1,131,708 tons handled to date. Belt No. 1, originally installed and put into operation in June, 1911, has handled 691,999 tons of ore and from all appearances is good for a repetition of this duty. Belts 6 and 7, a later installation, have been in operation since May, 1913, handling a total of 439,709 tons and showing little wear.

Power of Syndicate Managers

By A. L. H. Street*

Authority vested in the managers of a syndicate of stockholders in a copper-mining company to do anything deemed proper or necessary in carrying out the purposes of the syndicate is held by the Supreme Judical Court of Massachusetts, in a recent case, to have empowered the managers to employ a mining expert to complete a partial report of the value of orebodies controlled by the company. But the same opinion declares that the managers were without power to vote a block of stock to certain persons, to be delivered at the termination of the syndicate agreement, in consideration of faithful services rendered the company, howsoever commendable the action might be as a recognition of moral obligation. (Bradley vs. Borden, 112 Northeastern Reporter, 417.)

The Possibilities of Establishing Chemical Industries in South Africa is dealt with in an important report issued by the Development of Resources Committee of the South African Institute of Electrical Engineers. The report is confined to South Africa's chief industries, agriculture and mining. These industries taken together now require annually more than £2,000,000 worth of chemicals, all of which are imported in the form of fertilizers, cyanides and nitrates. The essential elements for the successful manufacture of the compounds are cheap electricity, abundant coal and limestone, and all these are available in South Africa.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Testing of Dredge Bucket Pins

By Ralph A. Young*

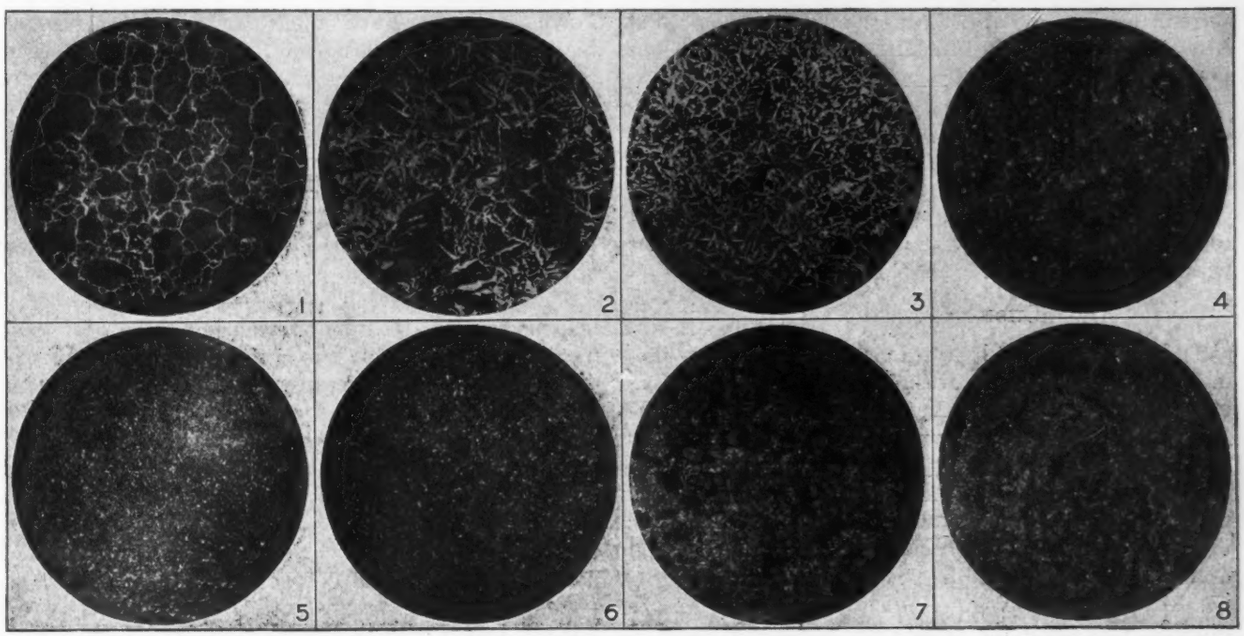
SYNOPSIS—While the use of alloy steels in bucket pins has been more or less successful in producing metal of the necessary hardness and toughness, prices are almost prohibitive. By experimenting with carbon steels and evolving proper annealing processes for the steel following forging, the search for carbon steels the equal of alloy-steels has been successful. Hard, tough carbon steels are now produced having a tensile strength of from 85,000 to 111,000 lb. per sq.in.

In the mining of gold by the use of the elevator dredge, one of the great problems that confronts the engineer and dredgeman is the securing of suitable pin material to hold the bucket line together. There is an old adage that a chain is no stronger than its weakest link, and this also holds true concerning the bucket line, as it is as strong only as its weakest pin. It is absolutely essential, therefore, to have a pin as perfect in workmanship and design as can be produced. In addition, the pin must be of sufficient hardness to withstand without lubrication the wearing action of sand and yet be tough enough to stand up under severe shocks and constant vibration.

Of pertinent interest at this time is a brief history of the dredge pin, which serves to show in a measure wherein some of the materials used in the past have failed. The first pins ever brought to the writer's notice were forged from steel of about 0.25% to 0.30% carbon, machined and placed in the bucket line. These pins, being very soft, soon wore and had to be replaced. The next pins were made from openhearth steel of 0.40% to 0.45% carbon content, and these gave better service, but were not trustworthy. About this time the size of dredge buckets was enlarged and hence it was necessary to increase the strength of the pins. Higher-carbon steels were used, some being made with carbon as high as 0.90%, but when this point was reached the leaf of the pins began to break, while the cost also increased owing to the difficulty in machining.

Oil tempering at one time was reported to be the proper treatment of all pins. This consisted in heating the pins to a dull red—about 1,200° F.—plunging them into a tank of tempering or fish oil and allowing them to cool in the oil. This process, if properly carried out, would relieve all internal stresses produced in the pins during the forging process, but often it did more harm than good, owing to the fact that the pins were not evenly heated throughout; therefore, instead of relieving the strains, the tempering set up new ones, so after being placed in service, they soon broke when subjected to severe shocks and vibration. Various forms of tempering or heat-treating were then resorted to which, because of being performed by those who were inexperienced in such work, caused the pins to fail sooner than they would if they had been used as forged. Nickel, nickel-chrome, chrome and chrome-vanadium steels have also been used with varying success.

In the use of the alloy steels the purchaser, unless he employs a metallurgical engineer, is somewhat at the mercy of the manufacturer, for he may buy alloy steel at a good price, but if the manufacturer has a tendency to be unscrupulous, he may furnish an inferior grade of material, and the service obtained is no better than that of ordinary steel. Some very good results, however, have



FIGS. 1 TO 8. PHOTO-MICROGRAPHS OF STEEL BILLETS

Figs. 1 to 3—Showing different grain structure due to varying temperatures of forging. Figs. 4 to 6—Results of Annealing. Figs. 7 and 8—Finished steel

*Chemist and engineer of tests, the Marion Steam Shovel Co., Marion, Ohio.

been obtained from the use of the alloys named, and much is to be said in their favor, but at the present time it is almost impossible to get some of these alloys, except at a prohibitive figure.

With the advent of improved methods of manufacturing manganese steel, it appeared for a time as if the dredge operator had found a panacea for all his troubles, and for many purposes it has given splendid success, but not for use in dredge pins. Manganese steel is a metal with a high coefficient of expansion and a very low heat conductivity. A dredge pin in use on one of the larger machines is a thick piece of metal ranging up to 7 and 8 in. in diameter, and unless the manner, speed of heating, temperature used and quenching are absolutely correct, internal checks develop that do not show up at the time of manufacture, but usually do shortly after the first use in service.

Another point that must be taken into consideration is the cost. Manganese steel, to be of any value, must contain from 12 to 13% manganese, which means the addition of about 20 lb. of 80% ferro-manganese to every 100 lb. of steel. One has only to glance at the quotations in the daily metal market to see the reason of the recent advance in price of manganese steel. In 1914, 80% ferro-manganese sold at $36 per ton; today it is quoted at $400 to $450 per ton. In addition to the first cost, one must add that of heat-treatment (manganese steel is almost worthless as cast), also the cost of grinding, because it is too hard to machine and must be ground to shape. Another point worthy of consideration is that when a manganese-steel pin is taken from a line for any cause whatever, it is worth only its price as scrap, as it cannot be forged out into anything else, as is often done with the carbon and other alloyed steel pins.

Carbon Steel Choice Governed by Experiments

The foregoing facts have led the writer to try to produce in a measure from carbon steel the same results, or better, that have been attained by use of alloys. In the first place, by careful experimenting and from a knowledge gained by past experience, a steel was chosen whose carbon content would, with proper treatment, produce a high degree of hardness and yet retain sufficient toughness to prevent breakage. The next step was to secure metal of uniform composition, free from burnt oxides, incorporated slag and piping. Metal thus described, can be procured only from the mills where great care is taken when the steel is made, by using a fine grade of melting stock, melting properly, taking tests of metal from time to time, and when the desired carbon is reached, tapping the metal from furnace and pouring.

The practice in some plants is to run the carbon down rapidly by use of large quantities of iron ore, then when tapping, to bring the carbon up to the desired point by the addition of pig iron, coal, coke or mixer metal. The last-named method is not so bad, but the others at times have a tendency to leave incorporated gases in the metal, which cause small holes in ingots, and these holes when rolled show up in the billet or bloom in the form of seams.

Before tapping or when it is tapped into the ladle, the metal should be so treated than when poured in to the ingot molds, it will set rapidly, thereby not allowing carbon, sulphur, phosphorus and any minute particles of impurities to segregate. Metal properly treated in the ladle will shrink and have depression, or "pipe," at the top of the ingot. When this reaches the rolls, a sufficient crop (usually 9% to 10%) should be made to eliminate this defect.

The billets from which the pins are to be forged are rolled from this steel. When these reach the forge department, test drillings are again taken to check the mill, and test specimens are also cut from many of the billets, prepared and examined under the microscope for any incorporated impurities that might not show up in the chemical analysis. By examining specimens under the microscope, cut from outside and center of the pins, it is possible to select a billet of the right size, so that the metal receives the effect of the forging all the way through.

It is a well-known fact that no two pins are finished at the same heat in the forge shop. Photo-micrographs, Figs. 1, 2 and 3 show the different grain structures that exist in different pins—in fact, at different points in the same pin, as that shown in Fig. 2 was taken from one end, and that shown in Fig. 3 from the opposite end of the same pin. Since the pins go direct from the forge to the machine shop and thence into the bucket line, such photos explain in a measure why one pin will wear and another one break.

When the pin leaves the forge shop, it is sent to the heat-treating department. This operation is one of the most important in the whole process of manufacture, and here every operation is safeguarded by the finest of instruments. When steel is heated to a certain temperature, physical changes take place, and in order properly to develop the greatest strength and hardness in a piece of steel it is essential to know at what temperature this change takes place, as different steels have different critical points.

The photo-micrographs shown in Figs. 4, 5 and 6, will help make plain the results attained by the heat treatment. Fig. 4—Sample was heated to 1,450 deg. F. and cooled. Fig. 5—Sample heated 50° F. higher than sample 4, or 1,500° F., and cooled. Fig. 6—Sample heated 50° F. higher than sample 5 or 1,550° F. and cooled. All were reheated to the same temperature. The physical properties were as follows:

Sample number	4	5	6
Tensile strength, lb. per sq.in.	99,900	111,250	98,500
Elastic limit, lb. per sq.in.	57,640	82,000	73,250
Elongation in 2 in., %	22.5	25.5	24.5
Reduction of area, %	48.9	60.8	53.3

Judging by the results of the physical tests, No. 4 was not heated quite to the transformation point; No. 5 was slightly over and at the right temperature, while No. 6 was heated too high. From this outline explanation is apparent the importance of knowing at what temperature the critical point is located, so the pins can be properly heated. To determine this, an instrument called a Transformation Point or Critical Point Apparatus has been placed on the market. When this point is determined, it is then necessary to have a properly constructed furnace or oven connected with recording pyrometers that are accurately calibrated against a standard.

In addition to the pyrometers it is the practice of the writer to place on every load of steel to be treated pyrometric cones that melt down when a certain temperature is attained. By placing these in all corners of the oven, it is an easy matter to see that all portions secure the same temperature. The rate of heating, fuel used, method of firing, manner of cooling, quenching and reheating are all carefully watched. Attached to the body of pin and

also to the leaf are prolongations of ample size for test bars. As soon as the heat treatment is complete, these bars are sawed from the pins and sent to the physical and microscopical laboratory. Specimens are prepared and examined under the microscope to determine if the heat treatment has been properly conducted, and if so, the specimen is photographed for record. The remainder of the bar is tested for hardness on Olsen's hardness machine, which tests for hardness by measuring the depth of penetration of a steel ball under a load of 5,000 lb. (This load may be changed, depending on grade of material.)

By comparing the results thus obtained with those from pins that have proven successful in the field, the hardness can be regulated. After the bar is tested for hardness, it is machined to standard 2-in. test bar and pulled for tensile strength, elastic limit, elongation and reduction of area. Should any of the tests not come up to standard, the pin is returned to the heat-treating department and the whole operation is repeated.

Figs. 7 and 8 show photo-micrographs of finished steel, and by comparing them with Figs. 1 and 2, one can see the changes effected in their grain structures by the heat treatment.

The following are a few results selected at random from a recently manufactured line of pins:

	1	2	3	4	5
Tensile strength, lb. per sq.in.	88,500	88,680	85,750	89,000	86,400
Elastic limit, lb. per sq.in.	55,700	54,100	53,400	58,250	52,610
Elongation in 2 in., %	23.5	28.0	24.5	21.5	23.6
Reduction in area, %	61.2	64.7	58.7	53.8	57.6

Arizona's Mining Problems

The establishment of a United States Bureau of Mines' experiment station at Tucson, Ariz., is hailed with satisfaction throughout the state. In explaining that satisfaction the Arizona State Bureau of Mines' letter says:

It seems to be a general conviction that a state leaping forward at the rate that Arizona has in the production of metals can have but few unsolved problems, but an analysis of the situation will show that this it not the case. Over 95% of the copper yield of the state is produced by 13 companies, out of 400 producers. There are thousands of mines in the state waiting for commercially profitable methods of reduction. As it is at the present time, with no facilities for metallurgical research, the only hope of the smaller companies having unsolved problems is to sell out to the large corporation with sufficient capital to carry its own research. This is evidenced by the many recent changes of ownership. The Calumet & Arizona spent thousands of dollars to develop a process for the economical extraction of the ores at Ajo, although the mine at Ajo is one of the oldest in the state.

Arizona literally abounds with problems. Immense low-grade deposits of copper are awaiting an economical method of treatment. The leaching of the carbonate ores of copper will bring to the state many hundreds of thousands of dollars, hitherto unavailable. The finding of an economical separation system for the large orebodies of garnet associated with copper will cause some large producers to operate. The utilization of the smelter smoke in the manufacture of sulphuric acid through finding a use for the acid will relieve many farmers, as well as expand the mining-business profits.

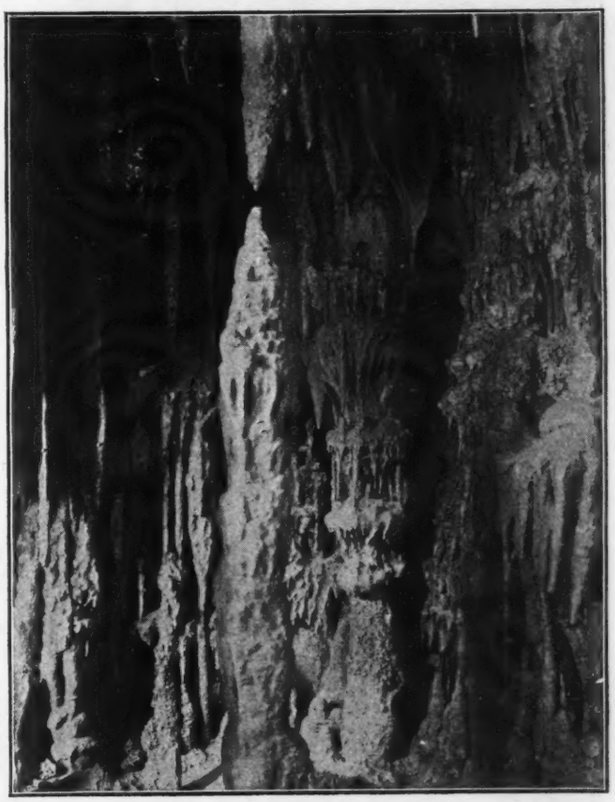
Although the problem of separating lead and zinc sulphides has been partly solved in other states, the methods of solution are not available for the immense deposits of these ores in Arizona, and means must be devised other than those which involve cheap power. Metallurgical research on molybdenum affords one of the state's greatest problems of its undeveloped resources. The cyanidation of refractory ores is another difficulty but partly overcome.

Copper Queen Cave in New York

By Walter L. Beasley*

In the course of mining operations at the Copper Queen mine, Bisbee, Ariz., a beautiful stalactite-lined cavern was recently broken into. Exploration proved this to be the entrance to a series of grottoes which contained a wealth of beautifully shaped and copper-tinted formations.

Fortunately for the preservation of such beauty to posterity, news of the discovery reached Dr. Edmund



REPRODUCED COPPER QUEEN GROTTO, NEW YORK MUSEUM OF NATURAL HISTORY

Otis Hovey, curator of geology at the New York Museum of Natural History. Before mining operations necessitated the destruction of the caverns, Dr. Hovey and three assistants visited Bisbee to attempt the preservation of at least a portion of the grotto formations.

In the interest of science the Copper Queen company placed the caverns at the disposal of Dr. Hovey for the museum. The grottoes had an age estimated at 25,000 years based on the length of time required to form the slow-building stalactites. The chief feature of beauty of one of these grottoes was a great greenish-white stal-

*69 W. 108th St., New York City.

agmite rising from the limestone floor nearly to the ceiling, a height of about 14 ft., its diameter at the base being about 15 ft.

Stalagmite is of extremely slow growth, and even under the more favorable conditions of growth at Luray Cave, Virginia, where actual measurements have been made, such a 14-foot mass would have required more than 17,000 years to form. Hence it is safe to assume that this grotto in the Queen Hill is much older than 17,000 years, since the rainfall and consequent solution is considerably slower in Arizona than in Virginia, though evaporation and consequent deposition is more rapid.

Having decided to attempt the reproduction of a portion of the caverns for exhibition purposes at the New York museum, Dr. Hovey and his assistants spent many weeks in skillful and patient work in carefully dislodging their required specimens. Some idea of the care required is obtained from the statement that the stalactites and stalagmites weighed from one to 800 lb. each. Fifty boxes of the beautifully tinted blue and green formations were collected from the ceilings, walls and floor of the grottoes and shipped to New York.

So beautiful were the caverns in their outlines and tinted formations that the curators were continually impressed that their work was little short of vandalism as it progressed, even though done in the interests of science. The acompanying illustrations of the New York reproduction of the cavern, however, will show why they have ceased to harbor regrets.

This work of assembling and jointing the large number of stalactites to form this museum cavern reproduction was a feat successfully accomplished under the direction of William A. Peters, an artist of the museum staff, who personally accompanied the expedition to Arizona.

The final reproduction of the cavern at the New York Museum of National History occupies a space 14 ft. high by 10 ft. long. The outside of the cave is roughly finished in limestone blocks and the interior, portions of which are shown in the accompanying illustrations, is viewed through a large glass panel. The natural color beauty of certain of these stalactites has been heightened by the use of concealed electric lights placed in many sections of the cave.

CORNER OF REPRODUCED COPPER QUEEN GROTTO

The Mines Development Act recently enacted by the Legislative Assembly of British Columbia provided a fund of $200,000 as an aid to mining development in the province. When development work, either on lode on placer claims, has proved the existence of commercially available ore deposits, public money out of this fund is advanced for the construction of trails, roads and bridges. When private individuals have undertaken the construction of such trails for the development of their mineral resources, 50% of the cost of this construction may be refunded at the discretion of the Minister of Mines.

Diamond Drilling at Sudbury

By L. A. Parsons*

SYNOPSIS—Statistics relative to the drilling of 100,000 ft. of holes at a cost of $2.53 per ft. Carbon- and fuel-consumption factors applicable to this district are given. The importance of surveying drill holes at regular intervals during their progress is dwelt upon and the question of deflection is discussed.

The statistics presented here have been compiled from the results of over 100,000 ft. of diamond drilling done by the Canadian Copper Co. in the Sudbury District, Ontario, during the last 14 years. Except for a small amount in the early days, practically all the drilling has been done on contract, and consequently much of the information that would have been valuable is more or less a secret with the contracting firms, so that the statistics are rather incomplete in some items.

The country rock consists mainly of a fine-grained norite, somewhat mineralized with pyrrhotite; occasional diabase dikes, and some granite and greenstone. The orebodies are large lenses varying from practically solid pyrrhotite (with subordinate amounts of chalcopyrite) to mixtures of pyrrhotite with smaller quantities of country rock. The majority of the drilling was in slightly mineralized norite, with occasional intersections of the other rocks mentioned; about 20% was in more or less pure pyrrhotite.

The holes considered here were all drilled from the surface. The majority were vertical and varied in depth down to 1,500 ft., averaging about 800 ft. In the early exploration days, when little was known about the orebodies, the location of the holes was somewhat erratic and varied as indications regarding the shape and extent of the orebodies were discovered. Latterly a more systematic method has been employed, and surface holes have been drilled vertically from the corners of squares not greater than 200 ft. on a side.

Screw-Feed Machines Used

E. J. Longyear Co. Nos. 1 or 2 screw-feed machines have been used exclusively in recent years and probably for most of the work. A hydraulic feed was used for some of the first work done, but was discontinued, I understand, because it caused too great wear on the carbons.

Various types of bits, rods, etc., have been used from time to time, but the equipment in most general use is as follows: Bits, "E" standard, inside diameter, $\frac{31}{32}$ in., outside diameter, $1\frac{7}{32}$ in.; core, $\frac{15}{16}$ to $\frac{7}{8}$ in., according to setting; hole, about $1\frac{9}{16}$ in,; core barrel, "E," outside diameter, $1\frac{7}{16}$ in., inside diameter, 1 in., length, 10 ft.; rods, "E," outside diameter, $1\frac{5}{16}$ in., wall, $^{15}/_{64}$ in., weight per foot, $2\frac{3}{4}$ lb.

In 16,248 ft. recently drilled, the carbon consumption was 214 carats, an average of 0.0132 carat per ft. Against this there is a record of 3,413 ft., when drilling was just starting, requiring 66 carats, an average of 0.0195 carat per ft. What the exact reason for this discrepancy is I cannot say. The latter may be just an erratic high figure or may be due somewhat to a combination of hydraulic feeds and drilling unknown ground. If the latter has much bearing on the matter, it would indicate that in drilling a new country allowance should be made for a carbon consumption somewhat above normal until the drillers become used to the ground, or else especial care should be taken with the early holes. I believe that the first figure of 0.0132 carat per ft. is about right for this district under present drilling conditions.

The drilling of 16,000 ft. required 650 tons of bituminous coal, an average of 0.04 ton per ft. In 3,883 ft. of holes on which wood alone was used as fuel, 330 cords of wood was required, an average of 0.085 cord per ft. In 1,802 ft. of holes both wood and coal were used as fuel, which cannot be separated. The coal was 36 tons and the wood 65 cords, an average of 0.02 ton of coal plus 0.036 cord of wood per ft. Although not of much use in themselves, these figures serve as a check on the separate ones already given.

Supplies and Rate of Progress

Miscellaneous supplies include oil, waste, odd nuts, bolts, washers, etc., small pipe fittings; in fact, all supplies other than fuel and carbons, except parts of drill outfit proper and large repairs. Of these supplies 14,289 ft. required a total of $536, an average of $0.038 per ft.

The time required to tear down, move and set up is usually two days for a crew of 5 men—1 setter and a runner and helper from each shift. This makes a total of 4 shifts running time lost when drilling 2 shifts, which is the usual procedure. This, of course, is for conditions where the next hole is already laid out and reasonably close to the one finished—within 100 to 200 ft.

The number of feet per drill shift is calculated for the net running time, obtained by subtracting from total time that required to tear down, move and set up. Thus 49,455 ft. of holes required 4,728 drill shifts, an average of 10.4 ft. per drill shift. Maximum 939 ft. in 72 shifts, an average of 13 ft. per drill shift. Minimum, 868 ft. in 104 shifts, an average of 8.3 ft. per drill shift. Some of these holes were inclined, but most of them were vertical.

The amount of lost core is an important factor in diamond drilling. At one mine where the country rock was solid and moderately hard, without excessive fissuring or cleavage planes, 30 vertical holes aggregating 14,007 ft. showed 156 ft. of lost core, an average of 1.1%. For 16 inclined holes aggregating 3,296 ft. varying from 60° to horizontal, the lost core was 315 ft., or 9.5%. Three of these inclined holes aggregating 1,647 ft. showed a total of 284 ft. of lost core, or 17.1%. This extremely high loss is due to the fact that the holes were drilled down the dip of the orebody and therefore entirely in ore. For some reason these sulphides grind much more rapidly in inclined than in vertical holes. By subtracting these holes of high loss, the remaining inclined holes show a loss of 1.9%, which is much more reasonable.

At another deposit, where the country has a rather more distinct cleavage, 66 vertical holes aggregating 56,419 ft. showed lost core amounting to 1,392 ft., or 2.47%.

*Mine engineer, the Canadian Copper Co., Copper Cliff, Ontario.

For eight inclined holes aggregating 2,974 ft., the lost core was 147 ft., or 4.95%. The inclined holes of both deposits quite consistently show more lost core than the vertical ones.

All holes here are surveyed for dip by the customary method of a glass tube and hydrofluoric acid. Surveys for strike are not practicable on account of the magnetic character of the orebodies. The following table gives the results for holes drilled in three different deposits here. Only the angle at the bottom of each hole is given, together with the distance from the collar, as intermediate readings would make the table too long. All the holes given were started vertically. In almost every case the deflection was gradual and cumulative, so that the total offset for the point given is considerably less than that obtained by calculating the curvature as a simple curve.

DEFLECTIONS IN DRILL HOLES

Deposit A		Deposit B		Deposit C	
Depth	Angle	Depth	Angle	Depth	Angle
200	89–30	400	86–45	333	87–30
400	89–30	400	84–30	400	83–15
400	88–30	550	51–00	600	89–30
400	88–30	600	81–30	600	89–45
600	88–30	600	68–15	791	84–30
600	90–00	600	80–30	820	87–30
600	88–30	668	89–15	1,000	83–45
600	85–00	716	77–30	1,000	87–00
600	83–15	731	82–30	1,000	85–15
800	90–00	762	85–00		
800	86–30	792	71–45		
800	88–00	794	65–30		
800	87–15	794	81–00		
800	90–00	800	86–15		
922	90–00	800	82–30		
931	86–00	800	82–00		
1,000	89–45	800	82–30		
1,000	81–15	800	78–15		
1,000	90–00	800	82–15		
1,000	88–00	800	86–00		
1,000	90–00	800	82–45		
1,000	89–00	800	83–15		
1,000	83–00	800	84–15		
1,200	87–15	800	83–15		
1,200	80–30	907	83–30		
1,200	86–00	924	83–15		
1,200	82–30	928	75–30		
		1,048	82–00		
		1,200	81–15		

Examples B and C are in ground much more difficult to drill straight than A. This is due somewhat to a more pronounced cleavage, but principally, I think, to the inclusion of numerous "bombs" of different rocks, offering to the bit glancing surfaces of varying hardness. These bombs were very well shown in the mine workings, and from their appearance in many places, I am surprised that many of the holes are as straight as they are.

The table illustrates some of the bad deflections that will occur under unfavorable conditions. In this connection I should like to emphasize the necessity for surveying holes at regular intervals as they are being drilled. It would almost seem as if this were too obvious to require mention—the fact that some holes deflect badly is common property—and yet a surprisingly large number of experienced men neglect this precaution only to find out too late that many of the holes have deflected so badly as to be in some cases almost worthless. In a new country with unknown ground it is particularly necessary. If holes start to deflect seriously, the usual remedies can then be tried before it is too late. And there is another advantage besides this—the regular measuring of the angle seems to have a good moral effect on the drillers, who take much more care where they know the hole is being checked. Ordinarily here, we survey at 200-ft. intervals, the first reading being taken after the first pull; that is, 10 ft. deep. If this reading does not check exactly the angle for which the hole was laid out, the machine is pulled off and the hole started again.

I do not know any rule for direction of deflection. In another district where a good deal of boring was done the inclined holes habitually deflected up. That is what one would expect from the mechanics of the thing; and yet here inclined holes habitually deflect downward for no apparent reason. When passing from a harder to a softer rock with an inclined contact, I should expect a hole to deflect away from the softer rock; yet here again they do the opposite. The only generality I can make is my first one: Don't theorize; survey the hole as it is being drilled and find out which way it is deflecting.

Nobody but the contractors know exactly what the costs here are. A typical contract would be $3 per ft. for the first 1,200 ft. and $3.50 per ft. deeper than that, contractors furnishing everything. I should analyze the probable costs somewhat as follows, based upon the prices obtaining before the war, instead of the more or less unstable conditions at present:

Assume one month of 30 days, 26 working days, of which 2 days are used for moving, giving 24 days, or 48 shifts, actual drilling time. Then 48 × 10.4 = 500 ft. drilled, for which the labor charge is: Setter, $150 per month; runner, 52 shifts at $3.50 per shift, $182, and helper, 52 shifts at $2.25, $117, or a total of $449, which is $0.90 per ft.

OPERATING COST PER FOOT

Labor per ft.	$0.90
Carbons, 0.0132 carat at $85	1.12
Coal, 0.04 ton at $5.50	.22
Other supplies	.04
Depreciation, repairs, water, etc.	.25
Total cost per ft.	$2.53

These costs of course are for a long contract. A contracting firm has many other expenses which cannot well be estimated, such as pay to employees between contracts, expenses for getting men and materials from their headquarters to the place of work to start a contract, unreasonable delay in being given the location for the next hole, etc. The item of water alone is quite variable and may easily amount to $0.25 per ft. or more.

Iron and Steel in Canada

The production of pig iron in Canada, according to the statistics collected by the American Iron and Steel Association, was as follows, in gross tons:

	1914		1915	
	Tons	%	Tons	%
Basic	331,456	46.9	660,369	80.0
Bessemer	184,053	26.1	13,714	1.7
Foundry	174,346	24.7	125,769	15.2
All other	16,117	2.3	25.568	3.1
Total	705,972	100.0	825,420	100.0

Of the production in 1915 a total of 803,646 tons was made with coke and 21,774 tons with charcoal. In all 671,510 tons was converted into steel or otherwise used by the makers and 153,910 tons was merchant iron, for sale. As to delivery, 598,221 tons was delivered from the furnaces in molten condition, 180,770 tons sand cast, 46,410 tons machine cast and 19 tons made into castings direct from the furnace. Ontario made 450,774 tons and Nova Scotia 375,246 tons.

The raw materials used were 1,609,032 tons of ore, cinder, etc. (4,367 lb. per ton of iron made); 512,379 tons limestone flux (1,391 lb. per ton); 1,070,437 tons coke (2,632 lb. per ton); 1,314,357 bu. charcoal (108 bu. per ton). There are 17 coke furnaces in Canada, nine in Ontario and eight in Nova Scotia; and two charcoal furnaces, both in Ontario.

The production of steel for two years was as follows, in gross tons:

	1914	1915	Changes
Openhearth	556,910	884,736	I. 327,826
Bessemer	186,158	22,521	D. 163,637
Other kinds	284	5,498	I. 5,214
Total	743,352	912,755	I. 169,403

The total in 1915 includes about 5,000 tons of alloy steel. The direct castings included in the total last year were 39,490 tons.

The finished iron and steel made in 1915 included 209,752 gross tons rails, 114,829 tons structural steel and wire rods, 328,737 plates, sheets, bars and merchant iron; total, 653,318 tons, a decrease of 6,201 tons from the previous year. The production of nails in 1915 was 1,636,000 kegs of 100 lb. each, an increase of 492,000 kegs over 1914. The production of splice bars and rail joints was 9,406 tons, the smallest for several years. The iron and steel forgings made were: Iron, 323 tons; steel, 21,775; total 22,098 tons, an increase of 13,960 tons over 1914. The production of cast-iron pipe in 1915 was 53,700 net tons.

Selling in South America

By Mark R. Lamb*

American manufacturers think the Canal is going to make it easier to market goods on the west coast of South America. It is, but the Canal is really a minor factor. The same people here will buy the same amount of the same things after as before the opening of the Canal. There are other factors that will have more influence in trade than the Canal opening.

Keep your traveling salesman away from Chile, Bolivia, Peru and Ecuador until he is entirely restored to health after his tongue has been operated upon for such words as "native," "Indian" and phrases like "We don't do it that way in the States" and "South Americans are terrible grafters." To the South American the North American who chews tobacco or eats cigars and says "Amurican" every minute is not a business man. He is given about as much consideration as is given to a Yogi in the States. He is a curiosity. He is courteously treated, but he goes home positive that there is no business for his house on the West Coast. His Masonic, Elk or Shriner button will be examined with respectful curiosity—and will as effectively bar him from business with conservatives as though he had cursed the Pope. Lord Chesterfield has said that it is impossible to protect a fool from the results of his folly. It is equally impossible to teach a provincial man to conform to new customs. That is why so many traveling men from the States insist upon having breakfast at hours unheard of here. He cannot eat the food indigenous to the country, and as though this were not enough, he talks about it all the time.

The other side of the picture is much pleasanter. The traveler with tact, experience and a knowledge of Spanish goes back with his book full of orders. Go into the hardware store to buy tools. The clerk shows you several grades of the same tool. "This is the genuine American, that is the English imitation and the other is the German imitation." The same happens with shoes, staple groceries, shoe-manufacturing machinery, and to a less extent with agricultural machinery, which is considered better while it lasts, but is cheaper and less strongly built than English lines.

Nowhere along the coast is there any organization resembling R. G. Dun. Credits must be investigated personally. The large trading firms have private credit departments—usually consisting of old employees who know the important stores, farms, mines and factories. The much-talked-of credits allowed here are the same as those granted the Kansas farmer or the country storekeeper on mortgaged crops or stocks of merchandise. American manufacturers can give these credits in South America when they have their men on the ground—not before.

Competition from Various Sources

German and English competition is real but not alarming. German and English manufacturers are just as anxious to show a profit as are Americans. Usually they do not give credit to poor-pay people purposely. Two manufacturers of articles sold on the installment plan have their own staff in Chile, and both managers have told me that their collections average better than in the home offices.

The usual remark one hears about electrical machinery is that the German leads in quality and sells at a lower price. This is perhaps due to the fact that German companies control most of the power plants in Chile, and they naturally prefer and favor German products and recommend to their power customers the purchase of German motors. The business is not a monopoly, however, and methods are fair and aboveboard. It is merely a question of salesmanship. In ships, large engines and nitermining plants, English products are favored because most of the nitrate companies are English-owned. There is but one American company in 150.

Credits need careful handling. The West Coast buyer considers the subject in a very different light than do Americans. As an example, he may promise to pay on a certain date and then peremptorily decline to do so, though he finally pays in full and with interest and has no intention of avoiding payment. This is fatal to credit, according to American ideas, yet the buyer is a good customer and worthy of credit. The South American business man is as suspicious of his own countrymen as he is of foreigners, and my own experience is that his suspicions are not well founded.

Selling through agents is a good or bad plan, depending solely upon the agent. A manufacturer of Boston garters, for instance, cannot afford a branch office, yet he could do better than he is doing now. So far I have not found the 25c. kind at less than 75c. per pair.

The general wholesale cloth merchant, however big or old or influential, is not a good agent for assay balances or microscopes. There are suitable agents for every line and some are so suitable that they represent every manufacturer of a given line of goods, thus making a profit whichever article is bought and not pushing any particular product.

Other agents seem to get orders only when the buyer holds the order in one hand and a gun in the other. One noted manufacturers' agent expects his salesmen to sell kerosene, ready-made suits, locomotives, barbed wire, battleships, house paint, smelters and shoes. The salesmen attempt it.

Commercial travelers from the States are canvassing this territory with increasing frequency lately and their

*Allis-Chalmers Co., Santiago, Chile.

complaints, when they have them, have a curious sameness. "Our agents don't know our line." "Help us find a suitable representative." "I sold more in a week than our agents sold in a year."

The problem is the manufacturer's as much as it is the traveler's. The manufacturer must choose between giving his business to an agent already overloaded with agencies and picking his man. Then in exchange for a little judicious encouragement in the way of expense money or consigned stock, insist on personal selling endeavor. It is all a question of choosing the man. I know a man who sold an automobile "from a catalog" immediately after getting the representation. He will probably go right on doing it, but he would sweep the field with a few consigned machines.

Where the manufacturer's line is large enough, he should have his own representative attending to the line exclusively. For the reason for this, put yourself in the place of the agency. When the competition is keen, he asks for a special discount to meet it. Then he gets the bad habit of always expecting a special price. When shipping, boxing and loss-in-transit difficulties arise, the agent is not nearly so sympathetic with the shipper as he is with the buyer; but your own man can see your side of each misunderstanding.

Your own man knows your factory, customs and goods. You are used to meeting this real competition in the States, but it is a rare thing to find a man from the factory here. When he does comes regularly, he gets more than his share of the business, because "agents" have little or no chance to compete with him.

The cultivation of trade along the West Coast requires the same methods and system that the Hudson Bay Co. used two centuries ago. If you, a Boston manufacturer of carpets, planned to open a market in the far West—say San Francisco, Chicago or Pittsburgh—you would not appoint as agent a fruit grower or a boiler maker or a miller. You would not expect credits, packing and price conditions to be the same as in Boston. You would find out just what the conditions were and conform to them, as much as necessary.

Rough Handling South of Panama Requires Heavy Packing

The American manufacturer is much blamed for the condition in which his goods arrive in Chile, Peru and Ecuador. He is not to blame—and he is. Loading at New York is normal and the goods are not mistreated. Unloading and loading at Colon is normal. But with the unloading and loading at Panama trouble begins. Photographs are useless for demonstration purposes. Only a moving picture could give a correct idea. Imagine a piano, cases of bottles or kerosene tins as forming a working platform in the ship's hold. A rope net is filled with kegs of nails, spools of barbed wire, tinned peaches and glass in cases. The sling load is run out over the hold and with a few bangs against the ship's side is lowered until it reaches the platform in the hold. As the stevedores are in a hurry, the sling is not lowered gently, so something is smashed a little. Also, on account of the hurry the net is not unloaded by hand, but instead, one corner is hooked to the line and the net is jerked to the wharf. If a spool of wire or a case gets caught in the net, what of it? Just shake it loose—and down it goes and something has to "bust" After this happens a few times, the kerosene tins are shifted so that the stevedores will not get oil on their feet—or they move the cases of glass to save their feet from being cut.

This is the beginning. Cargos are frequently unloaded at Callao into barges swinging and banging against the ship's side and loaded onto other ships bound south, though by waiting a day longer the goods could go on a through ship.

The unloading at Mollendo for southern Peru and Bolivia is simply horrible. At Antofagasta it is somewhat better and at Valparaiso better still. But nowhere is the ship or the captain at all interested in delivering the goods to the shore. The captain's troubles end as soon as the goods are overboard, whether into barges or into the sea. I have stood at the rail with a captain and seen three big barrels of crockery slip from slings one after another into the sea, while the captain did not even change the subject. The barrels floated slowly away and were twenty minutes sinking, and no one bothered them. I have seen borax loaded at Antofagasta in sling loads of ten bags each. The load was dragged over a ragged plate, and two bags out of each of 48 slings were torn open and lost before any attempt was made to cover the plate. The owner lost. The captain never even knows of it, much less cares.

Some of the handling will be avoided with the Canal open, but the worst of it will still remain. The "answer" is to always bear the handling in mind while packing. It does no good to say that the goods should not be handled so roughly. Of course they should not, but they are. Then make your cases so strong that they break the other fellows. This amounts to considering everything else as protection for your goods.

The Lure of Liquor

This does not apply to liquors, which cannot be packed so that they will not break. A convenient way to break a case of liquor is to notify the winch man when liquor is being unloaded; he can drop it quite hard when he tries. In case this fails to break a bottle, lift the case over your head a few times and drop it to the bottom of the barge or ship. This will break one bottle, after which the rest is easy. After all have had what they want from the dripping case, set the case cornerwise over a bucket under the forward hatch.

Pack light loads in heavy boxes and do not make them of unusual or inconvenient shapes. Practice packing, using enough strap iron and heavy lumber so your cases can be dropped to a cement floor say five times from a distance of ten feet.

Crates are of course merely a waste of good wood. On fragile shipments use double cases with big jute-padded corners. The customer expects, offers and begs to be allowed to pay for special packing. It is better to put the special cost of packing in the quoted price .

Do you realize what it means to say that all of the unloading from Panama south is done into boisterous, bobbing boats and not to wharves? I saw ten tons of tin concentrates worth $10,000 sink at the ship's side in rough weather because the captain would not take it. It had been splashed with sea water and made heavier than the bills called for. Conditions will be a bit better with the Canal open, but unloading will always be difficult and cases should always be small and as strong as possible.

But the one thing that will help more than anything else is to insure against all risk to destination and then hold the receiving steamship and the insurance company strictly to account for losses. Do this insurance for your account instead of for customer's and if you are not big enough to handle the fight, combine with other shippers. The insurance company can recover from the steamer, and you can do the same. Concerted action on the part of the shippers would work a wonderful change. The unfortunate buyer, no matter how big, has little chance or skill in recovering from the insurance company and will frequently not try, contenting himself with telling all his friends and clients how unbusinesslike Americans are.

It seems easy for us on the ground to realize that what particularly interests the buyer is the receipt of the goods in good condition. All of this may be condensed into a few words:

Regular price		Higher price
Ordinary packing		Strong packing
Rough handling	vs.	Rough handling
Broken cases		Sound cases
Dissatisfied buyer		Joyful buyer
No repeat orders		New friends

Miami Reverberatory Furnaces*

In constructing the reverberatory furnaces at the International Smelting Co.'s Miami, Ariz., plant, the following method of bottom construction was followed to eliminate any possibility of trouble in starting.

Broken slag was brought in railroad cars from the Old Dominion smeltery and melted in a small blast furnace obtained by setting up a number of discarded furnace jackets and a motor-driven blower on the site for the reverberatory furnaces. The molten slag thus obtained was conducted in launders to the foundations of the reverberatory furnaces. Heavy concrete beams and struts were provided between the furnaces for taking the thrust from the lower ends of the buckstays. Later, the spaces between the concrete struts and the beams were filled in with molten slag obtained from the regular operation of the reverberatory furnaces. The slag bottom was covered first with a 4-in. layer of fireclay and then with a 27-in. layer of silica (94% SiO_2) crushed to minus ¼-in. These bottoms gave no trouble whatever in starting up.

The method of side charging, instead of fettling only, along the side walls of reverberatory furnaces, now so successfully used by the Canadian Copper Co. and the Anaconda Copper Mining Co., was developed after the construction of this plant was well along. The plant had been laid out for charge tracks running at right angles to the furnaces near the firing end. In order to distribute the charge along the sides of the furnaces, change hoppers were placed, as shown at the left of Fig. 1, under the charge tracks directly over the side walls of the furnaces. Drag-chain conveyors were installed, one over each side of each furnace, which received the charge from the charge hoppers. Under these conveyors, approximately every 30 in., suitable down-spouts with gates were provided, as shown in Fig. 2, so that the charge may be distributed along the side walls of the furnaces throughout their length. The bridge-wall and side walls at the firing end of the furnaces are charged by drawing directly from the hoppers through suitable spouts. The floor over the charge tracks around the skimming end of the furnace was paved with firebrick.

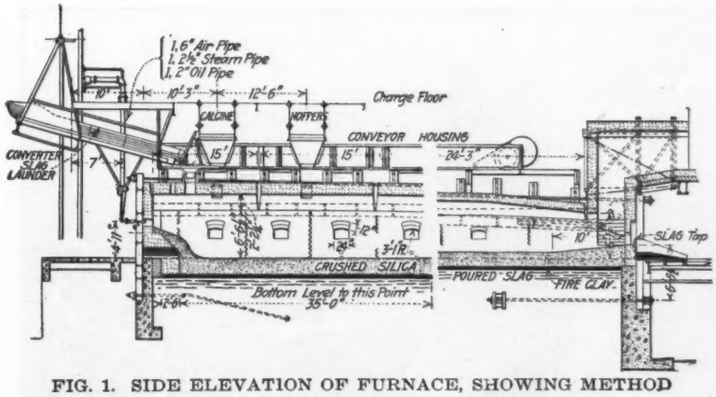


FIG. 1. SIDE ELEVATION OF FURNACE, SHOWING METHOD OF SIDE CHARGING WITH CONVEYORS

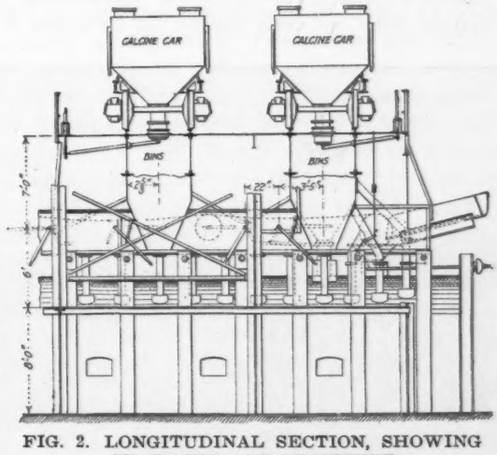


FIG. 2. LONGITUDINAL SECTION, SHOWING CHARGING ARRANGEMENT

*Excerpt from "Features of the New Copper Smelting Plants in Arizona," a paper to be presented at the Arizona meeting of the A. I. M. E., September, 1916, by A. G. McGregor, Warren, Ariz.

War Importance of Platinum

Soon after the great European conflict began, and Russia, France and England had declared an embargo prohibiting the export of platinum, its price began to soar. From about $40 per oz. just before the war the price jumped to about $100 for a short time, but declined in recent months to from $65 to $85 per oz.

It is generally known that Russia produces 95% of the world's supply, which totaled some 300,000 oz. annually before the war, but decreased to 240,000 oz. in 1914 and to a little over 200,000 oz. in 1915. The domestic production of this country is comparatively insignificant, totaling only 400 oz. in 1900 and about 700 oz. in 1915.

It is commonly thought that the great increase in price resulted from the Russian embargo, along with its one-third curtailment of production, the popular idea being that platinum is used mainly in jewelry and electrical machinery with insignificant quantities employed in the chemical laboratory and in the manufacture of chemicals. As a matter of fact, the declaration of war brought the chemical manufacturing business to the highest pinnacle ever attained in its history. And for reasons now to be detailed, the demands upon the chemical industry led to an unprecedented use of platinum.

Platinum in late years has become indispensable in the manufacture of sulphuric acid so necessary in the produc-

tion of enormous quantities of guncotton—smokeless powder and other high explosives. Some idea of our vast domestic production is obtained from the fact that in 1915 the United States produced 3,868,150 tons of sulphuric acid, valued at nearly $30,000,000. Of this amount, 1,056,830 tons, having a value of $7,042,126, was produced as a byproduct at copper and zinc smelteries. While formerly the bulk of the acid production was made in the well-known lead-chamber process, in recent years the so-called contact process, employing platinum as a catalytic agent, has revolutionized the industry.

While the catalytic property of platinum was discovered in 1831 by Peregrine Phillips, an Englishman, it remained for Germans in recent years to seize upon the idea of utilizing it in sulphuric-acid manufacture and build up an immense and extremely profitable business. Today, the contact process is known and used in all countries. It consists simply in passing a mixture of SO_2 gas and air over finely divided platinum heated to about 450° C. In contact with this hot platinum the oxygen of the air unites with the SO_2, forming SO_3 in long crystalline fibers, which readily dissolve in water to form sulphuric acid.

More Copper Mines in Cuba

Following the development of the rich Matahambre mine in the Province of Pinar del Rio in western Cuba, there has been much prospecting going on in this part of the island with the result that several rich copper deposits have been disclosed.

About 25 km. southwest of the Matahambre mine, the Candida mine has been opened by Cardenas & Co. and Benigno Prida in partnership with Gen. José Miguel Gomez, ex-president of Cuba. This new copper property comprises about 300 hectares in the foothills of the Sierra de los Organos, which runs nearly the length of the Province of Pinar del Rio in a northeasterly direction. The first shipment of 1,500 tons from the Candida mine was sent to New York early in the summer and averaged 15½% Cu, 6.25 oz. Ag, 32% Fe and 34% S. The ore was taken from a 30-ft. winze, sunk at the end of an adit that extended into the hillside about 75 ft. At the bottom of the winze a crosscut was run 15 ft. in each direction without getting out of the orebody, though one side was in low-grade ore. About 8,000 tons of ore of various grades have been mined, but to date the extent of the orebody has not been determined. The work has been in charge of Roberto Yrizar, a Columbia School of Mines graduate of 1895, lately manager of the Santa Ana mine, Catorce, San Luis Potosi, Mexico.

There is considerable prospecting still going on in this part of the province. Cardenas & Co., of Aguiar 116, Habana, together with Benigno Prida, control about 2,700 hectares along the northwestern slope of the sierra. These lands are supposed to contain copper and other minerals. It is noteworthy that while the ore from the Matahambre mine does not contain much silver, the ore from the Candida mine has a substantial amount of this metal. Of the area controlled by Cardenas & Co. and Benigno Prida, 400 hectares southwest of the Matahambre mine have been made the basis of a development operation known as the Sociedad Minera Nieves. This company is capitalized at $500,000 and has offices at Amargura 23, Habana, its president being Ramon G. Mendoza, a prominent lawyer. Preliminary work is being undertaken at this property, also under the direction of Mr. Yrizar; a shaft is to be sunk on the opposite side of the hill from the Matahambre mine.

To the north of the Matahambre, Maximilian Paetzold, Austrian consul at Habana, has been developing the Constancia mine near Viñales and has opened a new lens of high-grade sulphide ore. This mine was formerly operated by the McLaughlins and produced considerable ore, but was abandoned by them as being worked out. Mr. Paetzold controls a number of other properties in western Cuba and some of these are now being investigated by the newly formed West Indies Mines Development Co., of 25 Broad St., New York, which will develop some prospects in Cuba and in Haiti.

CANDIDA COPPER MINE, A NEW SHIPPER IN WESTERN CUBA

Prospecting is also in progress farther to the east in Cuba in Santa Clara Province. Near Fomento, a copper-zinc deposit has been opened by an 800-ft. adit and a shaft is now to be sunk by the Cia. Minera y de Fomento Watkins, of Lonza del Comercio 205, Habana, to determine whether copper or zinc is to predominate at this operation. Still farther east or rather to the southeast, the Cuba Copper Co. near Santiago continues to make a steady production from El Cobre mine—the first copper mine operated by white men in North America.

Details of Practical Mining

Shanking Drill Steels

By Charles C. Phelps*

The methods employed in shanking and sharpening drill steel have been undergoing a decided change recently. This is due to the fact that hammer drills are used to such a large extent. Every blacksmith has his own pet way of doing his work, but there are certain general principles and methods which, if followed, would produce much better results. Less attention is also being paid to the shanking than the sharpening, although shanking is almost equally important.

Shanks on drill steels are of three general types—plain, collared and with lugs. Plain shanks are used principally with hammer drills, which employ an anvil block to transmit the force of the blow from the piston to the steel. There is little to be said about this type of shank except that it should be dressed up square with correct dimensions and should receive the proper degree of temper to suit the conditions under which it is to operate.

Correctly made and treated shanks will result in a lower maintenance cost for both steels and drills and will produce better drilling results, hence careful consideration of this matter will be amply repaid.

Fig. 1 gives the correct dimensions for shanks for jackhamer and No. 26 Leyner-Ingersoll drill steels. Here the shank is hexagonal with a round collar.

Figs. 2 and 3 give correct dimensions for No. 18 Leyner-Ingersoll shanks on 1⅛- and 1¼-in. round steel respectively. Two lugs on the shank retain the steel in the chuck. It is absolutely necessary that shanks should be made of the correct size. If the shank is too long, the power of the blow will be reduced, and if too short, the front head will be compelled to take part of the blow. The shank lengths specified on the illustrations provide for inevitable wear, but this should not be permitted to proceed too far. In the case of the No. 18 Leyner-Ingersoll shank, for instance, it is unsafe to use a steel after the length of the shank, from the lug to the end, has been reduced by wear from $3\frac{13}{16}$ to $3\frac{9}{16}$ in. The correct diameter of shank is of equal importance, as too loose a fit will permit side play. The same effect is produced by permitting the front chuck bushing to wear to too great an extent before replacing. The striking face of a hammer-drill steel should be smooth and true. If this is overlooked, the piston will not strike the shank squarely and will soon start to chip. It is hardly necessary to refer to the injury that may be done to the interior of the drill by such chips of metal. The end of the shank may be trued by grinding on an emery wheel after hardening, or if this is not convenient, it may be filed before hardening. The edge of the striking face, should also be beveled off, to prevent subsequent burring of the metal. In squaring the shank end it is not safe to depend on the eyes unaided, but the use of a small metal square, is recommended. The end of the piston may also in time become worn somewhat concave. Should this occur, a square shank will tend to chip it, as in Fig. 4. The obvious remedy is to grind the piston off square, should it become belled on the end.

In the case of hollow steels for water-feeding drills, particular care must be taken to see that the hole is enlarged sufficiently to permit the entrance of the water tube without danger of breaking the latter. The enlarged section must be central and must be carried for a sufficient distance. Fig. 13 illustrates a gage which is convenient for proving up the diameter and concentricity of the enlarged hole.

Collars Formed by Hand

The first operation in forming collars on jackhamer and No. 26 Leyner-Ingersoll steels is to heat the steel to a cherry-red (1,500° F.) for a distance of 5 in. from the end; then cool the end by immersing in water to a depth of 3 in. The remaining 2 in. of heated steel is then upset by bouncing on an iron plate. The shank is reheated to cherry-red, a center punch is driven in the end of steel to enlarge the hole and prevent it from closing during forging. The steel is then placed between bottom and top collar swages shown in Figs. 15 and 17 and the collar is formed by hammering the latter, rotating the hexagonal steel between blows.

After a third heating to cherry-red, the punch is again inserted and the shank is swaged with the shank swage, Fig. 19, until the gage, Fig. 14, will slide over the shank. After again heating as before, the shank end is marked with the aid of the shank gage, and is cut off as in Fig. 12, employing a chisel of the type shown for the purpose. The shank end should be dressed up square and smooth with a file at this stage, unless this is to be done later by grinding. The shank is then ready for hardening.

Forming Lugs by Hand

The same general rules apply to the formation of lugs on shanks for No. 18 Leyner-Ingersoll drill steels. There are a few differences, however, as will be explained. The steel is heated to a cherry-red (1,500° F.) for each operation. The first heat is for 5 in., after which 3 in. of shank is cooled in water. The heated part is then upset. After the second heat the bottom swage, Fig. 18, and the lug-side former, Fig. 20 are employed. On the next heat the lug-diameter former, Fig. 21, is struck with the hammer while the steel is held in the other part of the bottom swage. On the same heat the lug-side former is again applied. During these operations the hole is kept open with the center punch. On the next heat the top swage, Fig. 22, is applied on both sides of the lugs to finish the ends of the lugs and round up the shank. Fig. 16 shows the shank gage used with these steels. After reheating, the steel is cut in the same manner as previously indicated, using the gage as a guide. The shank-end former, Fig. 23, insures the end being the correct diameter, with the hole central and of the correct

*Ingersoll-Rand Co., 11 Broadway, New York City.

size. It also helps to square up the end and round off the edges.

The following table gives the dimensions that are missing in the accompanying tool illustrations:

TABLE OF SIZES

Size Shank	A	B	C	F	G
1 1/4	1 1/8	1 3/4	5/8	1 3/32	3/8
1 1/4	1 1/4	1 7/8	11/16	1 5/32	11/32

After the sixth and final heat, the shank should be hardened.

If the steel is heated and collared in a shank-forming appliance in one operation, the result would be likely to develop a "cold shut," as illustrated in Fig. 5. Here it is apparent that the hole tended to enlarge more rapidly in proportion to its size than the collar, leaving

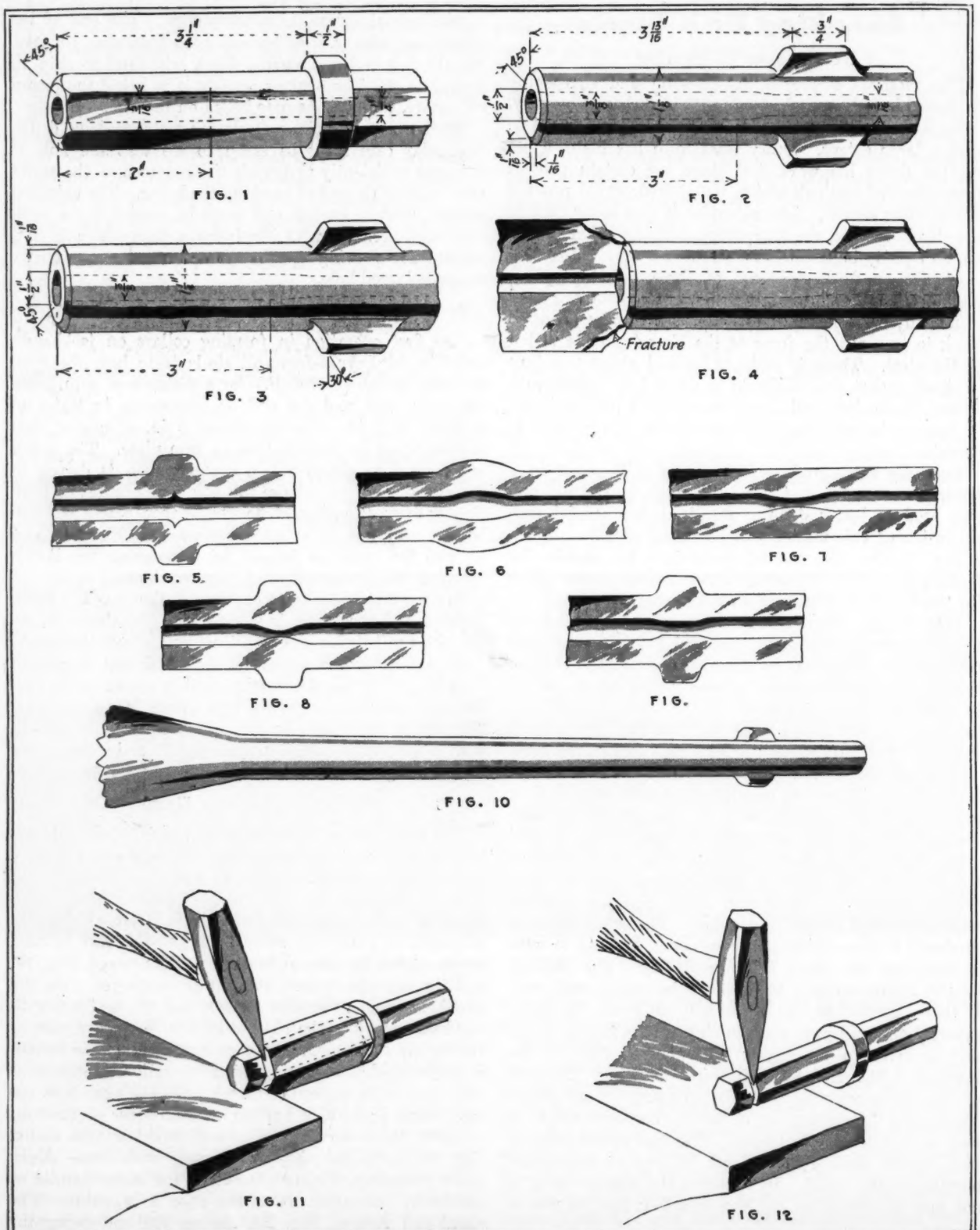


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG.

FIG. 10

FIG. 11

FIG. 12

SHANKING DRILL STEELS

the metal folded down on itself. To obviate this condition, the steel is partly upset until it assumes the form shown in Fig. 6, in which the hole is considerably enlarged and the collar but slightly formed. The next operation is to form the steel down to its original section, as shown in Fig. 7. This leaves the hole almost closed and the stock considerably upset at the point where the collar is to be formed. With the hole in this condition, it cannot enlarge as in Fig. 7, but on the contrary, when the steel is placed in the machine and upset, the hole takes the form shown in Fig. 8. By the use of the drifting pin the hole is formed as shown in Fig. 9.

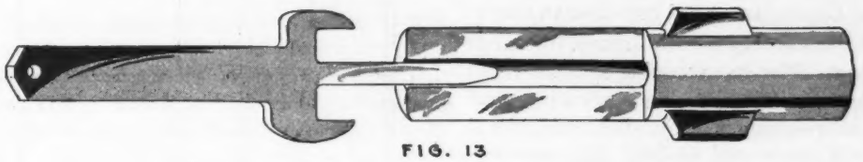


FIG. 13

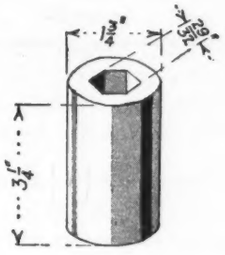


FIG. 14

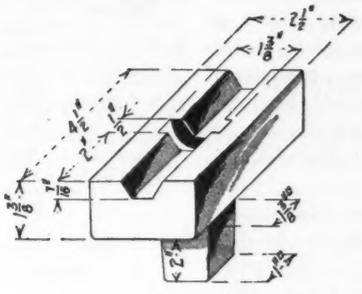


FIG. 15

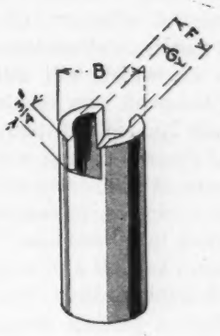


FIG. 16

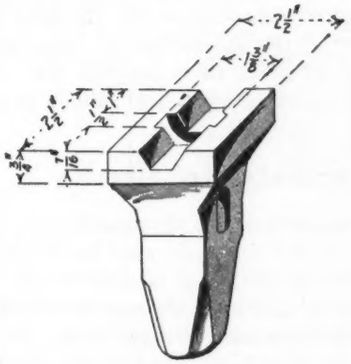


FIG. 17

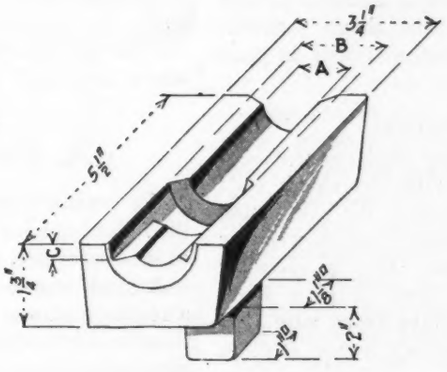


FIG. 18

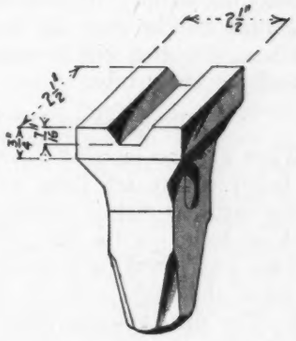


FIG. 19

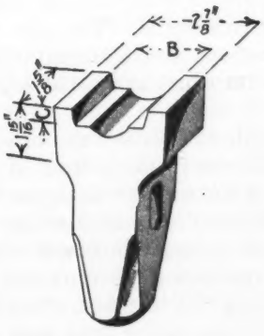


FIG. 20

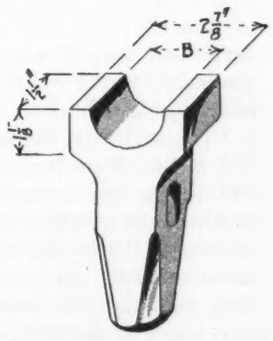


FIG. 21

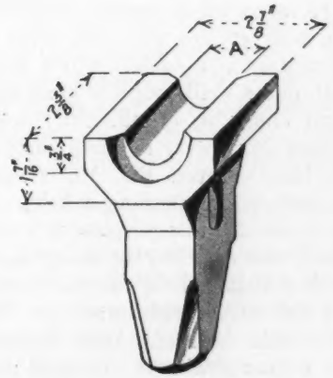


FIG. 22

FIG. 23

GAGES AND SWAGES

All dimensions are taken care of by the standard equipment. When a shank-forming appliance is used, a pin-puller which bolts on the side of the machine will be found of great assistance in removing the steel pins which it is necessary to insert in the hole of the steel during the several forming operations. The pins are removed from the steel by resting the end of the shank against the face of the pin-puller, clamping the pin by bringing down the small lever and forcing the pin out by throwing over the long lever.

Harden Shanks Carefully to Avoid Breakage

One of the most prolific sources of shank breakage is improper hardening. Plunge-tempering is more rapid than draw-tempering, and it is considered more practical in every way. It is recommended to heat the shank slowly and evenly to a cherry-red (1,500° F.) considerably beyond the collar or lugs; a total distance of 7 in. gives good results. Collared steel should then be quenched in soluble oil, which will impart a suitable degree of temper. Steel with lugs should first be dusted by throwing a small handful of powdered yellow prussiate of potash on the shank and especially around the lugs; this increases the hardness of the metal on the surface and greatly improves its wearing qualities. The shank is then quenched in soluble oil.

Fish oil and lard oil are recommended for this purpose, and it is advisable to keep the oil cool, which can be done conveniently by placing the can of oil in cold water. Shanks should never be quenched in water for it makes the steel entirely too hard, which tends to cause fracture of the drill piston. On the other hand, should the heat treatment not be such as to give the shank sufficient hardness, the end will become upset and will in time cut off the water tube.

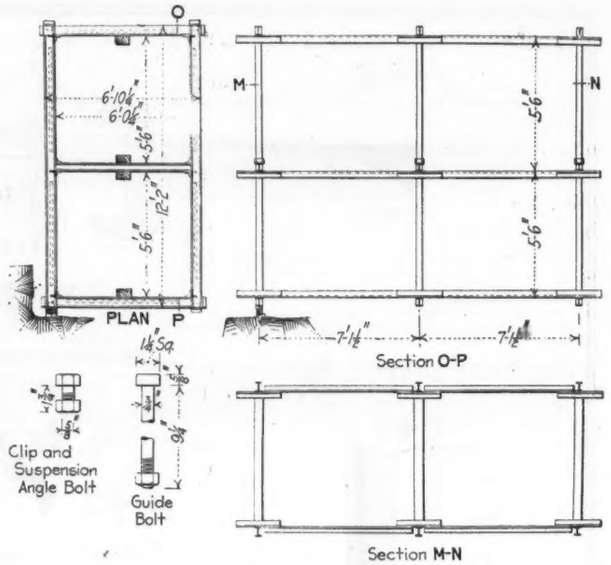
Precautions In Using Steel

When drilling or when sharpening steels, care should be taken not to set them aside with the shank ends in the earth, as dirt or pebbles will enter the hole in the steel or lodge on the end, resulting in extra wear or perhaps even breaking a water tube. It is much safer to stand the steels with bit ends down or place them flat. The drill runners should always make sure that the shank end is clean before inserting a new steel in the chuck.

The piston, chuck-bushing, chuck keys and other parts subject to wear should be inspected at regular intervals. The proverbial stitch in time applies with full force to rock drills. Proper lubrication is a subject which principally concerns the drill, and a drill properly lubricated will keep the shank and chuck in a sufficiently well-lubricated condition to keep down wear of these parts as much as possible. The blind starter, Fig. 10, is most useful for squaring the rock before starting a hole. If it were used to a greater extent for this purpose, it would eliminate subsequent delay and difficulty in many cases, for it is a well-known fact that a hole can be started much quicker against a flat rock surface and the hole will be more likely to remain in line. With reduced rifling tendencies, there is less strain on the steel and chuck parts and less time wasted through having the drill hung up. "Tending chuck" with a bar is also reduced with its attendant injurious features. The reduction of lost time in drilling is a factor not carefully watched in the average mine.

Steel Shaft Sets*

In the construction of San Francisco shaft No. 2 of the Compania de Santa Gertrudis at Pachuca, Hidalgo, Mexico, steel shaft sets were used instead of timber to support the walls where needed. The members were bought cut to the proper lengths, but were fabricated



SANTA GERTRUDIS STEEL SHAFT SETS

locally. Five-inch I-beams were used for wall- and end-plates, while channels were used for dividers and posts. The illustration shows the method of fabrication. No. 18 galvanized corrugated sheet lagging was used where necessary. This steel support cost $20.33 per ft.

A Prospector's Stove

For muleback transportation to a permanent camp site the following adaptation of a household wash boiler proved so successful that others might find it of similar use.

A camp was to be established for the summer work in a region that was difficult to pack material into. A sectionalized iron stove was unavailable, and the single-piece iron stoves in stock at the outfitting point were too cumbersome and heavy. An ordinary tin wash boiler, elliptical in shape, was bought, together with one 2-ft. length of 6-in. stovepipe and one quarter-bend. The pipe and bend were packed with provisions and then put inside the boiler, which was filled with stores and given a place on the pack saddle.

Upon arrival at the camp site the boiler was unpacked and a 6-in. diameter hole was cut in the bottom of one end, the sections being bent at right angles to the surface to admit the quarter-bend. Two lid holes were cut in the bottom of the boiler, and a rectangular hole was cut in the other end. The boiler was then set bottom side up on a rock and the smoke pipe wired in place. Two lids were made of flattened tomato tins and a front door was made from the original lid of the boiler. Wood was used for fuel. This stove worked satisfactorily for the camp cooking for four men and lasted out the summer without burning through.

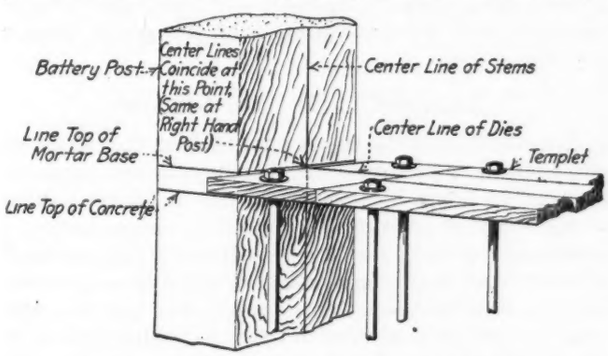
*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

Details of Milling and Smelting

Replacing Mortar Blocks

By Charles Labbe*

The mortar blocks in stamp mills were formerly made of planks bolted or spiked together; but nowadays concrete has replaced lumber for many reasons, among which the high first cost and short life are the chief factors. It is safe to assume the average life of wooden mortar blocks to be eight years. This may be considered to be nearly the life of the first stage of the mine, but many mines last much longer. Wood will age and rot whether the mill is in operation or not. In most of the mortar blocks replaced the trouble was found to have started from the bottom. On account of the sidehill location of the mills the pits were practically a drain for the surface water and mill water, which soon caused the wood to rot. Wood preservatives, when used, prolong the life of the wood,


Battery Post
Center Lines Coincide at this Point, Same at Right Hand Post
Center Line of Stems
Line Top of Mortar Base
Center Line of Dies
Templet
Line Top of Concrete

LINING UP STAMPS WITH A TEMPLET

but their use not general. In some blocks where the planks were put lengthwise with the mortar, the outside rotten planks may be changed, but it is noticed that the block needs repairing within a very short time. Taking all factors into consideration, concrete mortar blocks are the most serviceable.

Getting Ready for the Concrete

The first thing to do toward placing concrete mortar blocks is to get the mortar out of the way. The stamps must be raised as far as posible and held firmly. This may be accomplished by loosening the tappets and sliding them on the stem, or by putting a block on the finger jack. In many cases they will not be raised far enough, and the mortar will have to be moved away by taking the stamps out and putting them on the camshaft floor. The mortar is raised off the bolts with wedges and crowbars helped with chain blocks tied to the camshaft or battery girts. As this work always takes place after a clean-up, it is advisable to make the mortar as light as possible and to keep the dies and liners out.

To take the mortar away a strong cribbing is made of timbers not less than 4x6 in., with two heavy pieces (about 6x8 in. or 8x8 in.) laid lengthwise on the top, horizontally. On the top of the two heavy timbers lay bars of ½x3-in. flat iron, extending all the way under the mortar to keep the rollers from sinking into the wood. Do not forget that a five-stamp mortar weighs about three tons. With the mortar raised entirely clear of the bolts, place rollers made of 1-in. or 1½-in. round iron the entire length of the mortar. Then roll the mortar block away on the cribbing with the help of rope or chain blocks, helping and guiding the crowbars. Raise the mortar block as far as possible until it touches the girt, and hold it there with strong dependable chains tied to the girt and camshaft. This avoids the trouble of moving the mortar away and gives ample room for working in most cases. The next step is to take out the old wooden blocks. At first this seems easy, but any millman who has done it once will think differently. The planks extending above the floor are handled easily enough, but after that part has been disposed of the wood for a depth of 6 to 8 ft. has to be removed. Recalling several instances, I remember blocks set in solid concrete which had to be drilled and blasted just as in sinking a shaft. Augers were tried, but they did not work well in wet wood. The best results obtained were with holes 12 to 16 in. deep loaded with one-third of a stick of ⅞-in. 40% dynamite.

In another case the block was set with concrete on one side, solid rock on the other. After we had blasted 2 ft. of the block (this block rotted from the top) the wood was so fibrous that more holes for blasting were impossible; so we sunk a small shaft next to the block in the rock, which was easier to drill than the concrete, and got at it from the side. As quickly as the bottom is reached in any small place, the rest is quickly taken out and the most difficult part of the work has been accomplished. In an old 10-stamp mill the blocks looked very good from the outside; but when the mill was started up after years of idleness, the blocks sank at the rate of an inch a day. When taken out they were found to be sound for the first 6 ft., but the remaining 6 ft. was dug out with a spade.

The next step consists of putting in concrete blocks. The place is well cleaned of all wood and loose rock. According to the size of the rocks to be put in and the nature of the ground, it would seem advisable to bore holes in the rock on the bottom and sides and cement in rods or pipes for the purpose of anchoring the block to the rock.

Lining Up the Shoes and Dies

Two lines are drawn horizontally on the battery post—one to mark the top of the concrete, the other the top of the mortar base (sole plate). A templet is made of 2-in. boards, the holes traced and if possible bored from the mortar. The center line of the stems is extended to the bottom of each battery post, while on the templet is traced the center line of the dies. To be sure that the shoes will strike exactly on the dies, the center line of the die stems produced should be coincident with the center line of the shoes as marked on the templet. The templet

*Mechanical engineer, Nelson, Nev.

holding the mortar bolts in place is leveled and held firmly to the battery posts, the bottom of the nuts on the same elevation with the line of the mortar-base top.

The concrete is now ready to be mixed. A large pile of rock is wheeled near-by. The mixing platform has been erected as near as possible, so that the mixed concrete can be shoveled from the platform directly into the hole. The mixture should be 1-3-5 for the lower part with coarse rock; as the height is increased, the mixture is made richer; 1-2-3 in practice has proved very good for the upper part. The concrete must be well rammed until the water comes to the surface, and reinforced with iron rods or old steel cable. I have used tailings of 20 to 40 mesh, free from slime, for sand with very good results; and crushed stone from the waste dump or sorted from the crusher that has passed a 1-in. screen has proved satisfactory for the rock. The mud-sills and battery posts can be concreted in with the mortar blocks. The same anchor bolts are used for the mortar, anchored into the concrete with an iron bar or a large rail, one for every two bolts with large square cast-iron washers. The top of the mortar block is finished with a mixture of one part cement and two of sand, ½ in. thick.

This finishing must be done the day after the concrete has been put in, to remove the chances of the finish scaling off after the mill is put in operation, due to an imperfect bond. To straighten and level the top before it gets too hard, use a piece of square steel about 5 ft. long (a bar of heavy pick steel is very handy, as it is straight and the edge is sharp) with a level on top. The bar is used as a scraper to shave off the high spots.

Ample time is given the concrete to set. It requires two weeks for a block of such size to harden. It would be disastrous to try to save a few days and have the block crack. In dry weather it is advisable to cover the concrete with gunny sacks and to keep them wet for four or five days, thus preventing a too rapid setting of the outside portion. The forms are taken off 10 days after the concrete is put in, as there is less danger of breaking a corner when the concrete is still green.

If not damaged, the same rubber pad used on the wooden block is used for the concrete. The purpose of it is not to act as a cushion, but as packing to cause a true fit of the mortar. The mortar is set in about the same manner as it is taken out, and repair work is done to the battery if needed.

Put in a Concrete Floor at the Same Time

The cost of exchanging the wooden for concrete mortar blocks in a 10-stamp mill was as follows:

Labor:		**Hr.**
Raising mortar and tearing out old floor		16
Taking off wooden blocks and drilling holes for anchor bolts		60
Screening dump for rock, sand, talings wheeled to mill		72
Mixing and pouring concrete		96
Replacing mortar on new blocks and readjustment of batteries		24
		268
268 hr. at 47c		$125.96
Material:		
Reinforcing rods (from scrap pile)	....	
Lumber for forms (borrowed and returned to mine pile)	....	
60 sacks cement @ 80c	$48.00	
Freight, 3 tons @ $20	60.00	
		$108.00
Total cost		$233.96

While you have everything handy for mixing concrete and while your back and muscles are trained for this sort of work, put in a concrete floor for the tables, if you have not one already, as it is a great improvement over the warped and leaky planks usually found in floors. Six to 8 in. of concrete on a well-tamped ground with 1 in. of fine to finish will make a good floor. It can be inclined to drain all to one place. This floor should not touch the mortar block or battery post. About a 2-in. space should be left and filled with sand to prevent the transmission of vibrations to the tables, which would cause the floor to break in many places.

Flow of Air in Lead Blast Furnaces*

Toward the end of 1911 some experiments were carried out at the Cockle Creek smelting works of the Sulphide Corporation, Ltd., in New South Wales, Australia, to ascertain the behavior of the air entering the tuyeres of the lead blast furnaces. The furnaces at this plant originally had a height of 18 ft. from the feed floor to the tapping floor and were operated under a blast pressure of 8 to 10 oz. per sq.in. In 1900, Huntington-Heberlein pots were introduced, and the furnaces were built with a higher shaft, until at present a height of 36 ft. from tapping to feed floor is not uncommon. To give the increased blast pressure necessary for the higher stacks, piston blowers were substituted for the rotary blowers previously used.

Diameter of Tuyeres Studied

The diameter of the tuyere openings was the subject of some controversy between the metallurgical and engineering staffs. It was held by some of the metallurgists that a tuyere whose interior was conical in shape, having a comparatively small aperture at the furnace end, produced a better result than a similar tuyere with a large aperture, of, say, double the diameter. The idea was that the small opening produced a more intense or jet-like action to the entering air and therefore tended to improve the combustion. A consideration of the facts, however, from a scientific point of view hardly bore out this theory. The air pressure at the tuyere was presumably practically that in the blast main; and if the interior of the furnace carried no greater pressure than that of the outer air, or at any rate very little more, as was claimed by the advocates of the air-jet theory, the quantity of air delivered to the furnace, due to the difference of pressure, would be infinitely more than the blowing engines were capable of pumping.

On the day the experiments were made the pressure in the main blast main was 46 oz. per sq.in. The readings of the mercurial gage showed that the actual pressure in the tuyere was from 40 to 41 oz.; at 6 in. beyond the tuyere in the furnace the pressure varied from 35 to 41 oz. These tests were made with tuyeres having 3-in. openings into the furnace. The volume of air delivered to the furnace at the time, through the tuyeres, was 6,340 cu.ft., as ascertained by the displacement of the pistons in the cylinders of the blowing engines. Other tests were made with the noses of the tuyeres closed to 2-in. diameter by inserting annular pieces in the nose. It was found that to produce the same conditions of pressure in the smelting zone necessitated the raising of the blast pres-

*Abstract of a paper by A. W. Tournay-Hinde, read before the Engineering Association of New South Wales; reprinted in "Min. and Eng. Rev.," June 15, 1916.

sure to 51 oz. in the blast main, or, in other words, it required 5 oz. more pressure per square inch, or an increase of 9% in the blast pressure, to force the same volume of air into the furnace.

Large-Diameter Tuyeres Chosen

As the amount of smelting performed and the intensity of the temperature in the furnace depend upon the rapidity with which the coke fuel can be consumed, it follows that the method that permits the freest ingress of air at the lowest pressure is the most economical when the cost of power to operate the blowing plant is taken into consideration. Therefore, the large-diameter tuyeres carried the day. The experiment clearly proved that most of the kinetic energy in the air was dissipated in overcoming the resistance through the charge in the upper part of the furnace and that only about 2 to 3 oz. per sq.in. was expended in actually forcing the volume of air into the smelter. It should be noted that in arriving at the results mentioned the mean value of a number of readings was taken.

The sizes of tuyere openings during the experiments were 3 in. and 2 in. in diameter respectively, as has already been stated. Theoretically, at any given air pressure a 2-in. opening should deliver approximately about half as great a volume of air as a 3-in. opening. But the placing of an annular stopping or nozzle in the nose of the tuyere introduces other factors that modify the theoretical discharge. The air is supplied to the tuyere through a comparatively long pipe from the bustle pipe or air main surrounding the furnace. In the case under notice these tuyere pipes were 4½ in. in diameter and 9 ft. 6 in. long. As the air in this pipe is traveling at a high velocity, there is a relatively greater drop in pressure in the length of the pipe when the tuyere opening is 3 in. than when it is 2 in. in diameter—that is, with any given pressure in the blast main. The actual pressure per square inch in the tuyere with the 2-in. opening is therefore slightly higher than in the case of the tuyere with the 3-in. opening, and therefore the 2-in. opening passes rather more air than half the quantity that a 3-in. tuyere would.

From 3- to 5-oz. difference of pressure per square inch, between that in the tuyere and that in the furnace itself, would appear both by calculation and experiment sufficient to force the requisite quantity of air into the furnace. Suppose that the furnace was operating at 45 oz. per sq.in. and that it was desirable for some metallurgical reason to increase the blast pressure to 55 oz. This does not mean that there will be 10 oz. more pressure forcing air into the furnace, or that proportionately more air will flow, for the interior pressure in the smelting zone will rise proportionately with the increase in the external pressure. There will of course be a slightly higher difference of pressure between that in the tuyere and the smelting zone, and slightly more air will be forced in. So far as it was possible to ascertain, an increase of 10 oz. in the blast pressure produced an increase of only about 0.5- to 1-oz. effective difference of pressure for forcing air into the furnace.

To summarize the foregoing data, it may be postulated that:

1. The volume of air delivered to a blast furnace at any given pressure virtually depends entirely on the resistance offered by the condition of the charge in the smelting zone and shaft.

2. The pressure of the air in the smelting zone of the furnace with any given blast pressure is dependent on the tightness of the charge in the shaft and is independent of the size of the tuyere opening, so long as the tuyere area available will permit sufficient air to pass into the furnace for smelting.

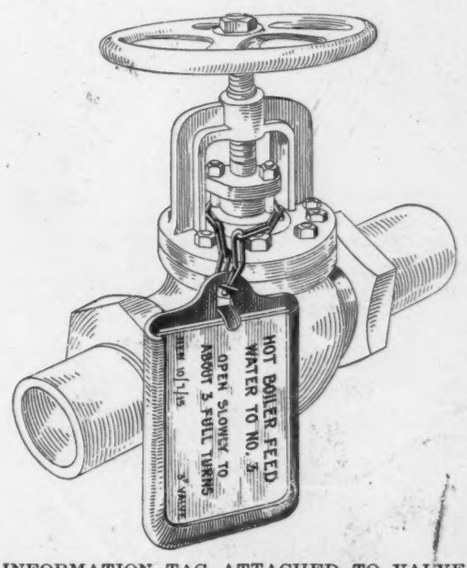
3. The pressure in the smelting zone is usually only 2 or 3 oz. and should not be more than 5 or 6 oz. below the pressure at the tuyere, as these differences of pressure are ample to pass into the furnace all the air required.

4. Variations in the pressure of the air in the blast main cause almost equal variations in the pressure of the air in the smelting zone.

5. Variations in the size of the tuyere opening only vary the amount of energy required to force a given volume of air into the furnace and do not materially vary the conditions of volume or pressure or smelting within the furnace.

Identification Tag for Valves

The frequent changes of help in our main plant caused much confusion and resulted in many mistakes in operating valves on the maze of small piping, says M. A. Saller, *Power*, Aug. 1, 1916, so we purchased a lot of



INFORMATION TAG ATTACHED TO VALVE

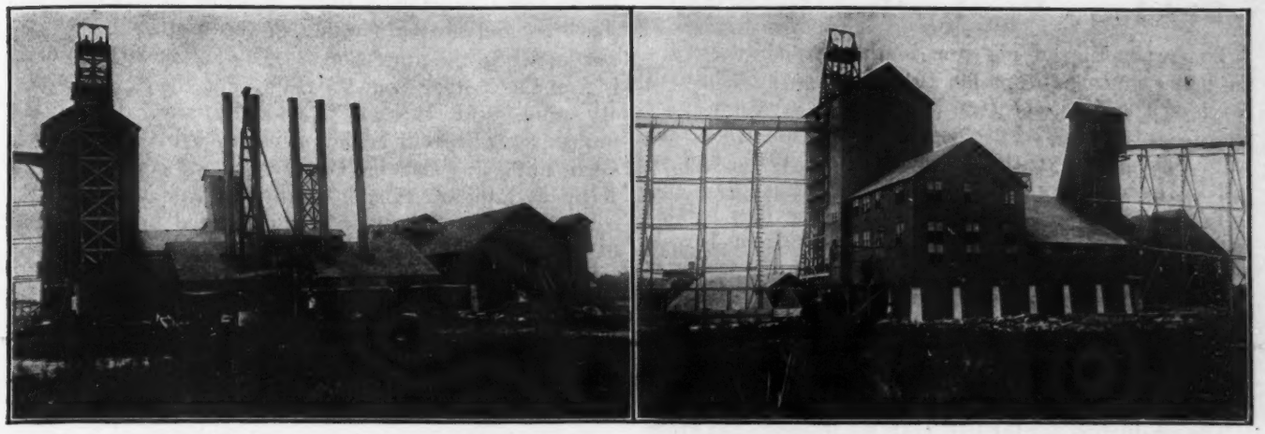
aluminum tags with protected white writing spaces. These were attached, by light chains, to the bodies of the valves throughout the plant, with an inscription on the tag as to the service of the valve, its size, make, date installed and any special instructions thought necessary.

A Plant for Cleaning Cement Bags by machinery has been installed by the Cleveland Railway Co., according to "Engineering and Contracting." The cleaning machine consists of a polygonal drum 12 ft. in diameter, whose periphery is wire screen of 1-in. mesh. The bags are placed inside the drum, which rotates 12 times per minute. The bags are cleaned 500 to 1,000 at a time, and two men can clean 1,000 bags per hour. About 700 lb. of cement is recovered from 1,000 bags, or over seven bags of cement. A saving of 700 lb. of freight for each 1,000 bags returned to the mill is made. Previous to installation of plant, three men were employed, whipping bags at a cost of $2,000 per year for wages.

Photographs from the Field

AN AËRIAL TRAMWAY THAT WORKS UPHILL

Owing to the lack of dump room at the Elkhorn mines in Kentucky, it is necessary to convey the waste over the crest of the mountain into the next valley. There are four double reversible aërial tramways, with American Steel and Wire docked-coil track cables, 1½ in. diameter, and $\frac{5}{16}$-in. crucible-steel traction ropes. The tramways vary from 550 to 1,035 ft. in length; each has a capacity of 30 tons per hr. Power is furnished by electric motors, direct connected



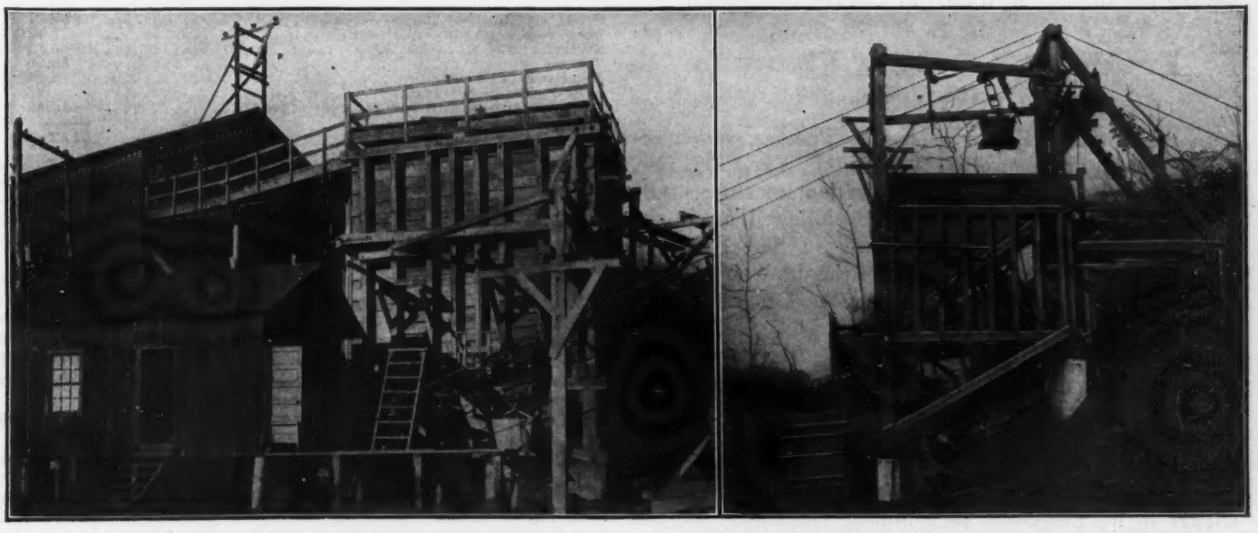
TWO VIEWS OF THE COAHUILA COMPANY'S NEW 1,000-TON MILL AT DUENWEG, MO.

One of the newest mills in the Joplin district; completed in August; numerous windows provide better lighting than in most Joplin mills. Note headframe at left

ROCK AND SAND FILLING AT THE CHAMPION COPPER MINE IN MICHIGAN

Rock filling was initiated at the Baltic mine by F. W. Denton and was generally adopted by the amygdaloid mines of the district to save timber

Sand filling is now used in conjunction with rock filling. This view shows the sand cars and chute at the fourth level, "E" shaft, Champion mine



LOADING AND DISCHARGE TERMINALS OF AN UPHILL AERIAL TRAMWAY IN KENTUCKY

Bucket in front of loading chute at one of the Elkhorn mines, Jenkins, Ky.

Tramway bucket at discharge terminal; about to engage tripper that relases contents

Pig-Iron Production in 1916

The production of pig iron in the United States for the half-year ended June 30, 1916, is given by "Bulletin No. 5 of The American Iron and Steel Association," just issued, at 19,619,522 gross tons, which is an increase of 1,937,100 tons over the second half of 1915, and of 7,385,731 tons over the first half.

Taking the second half of 1915 and the first half of 1916 together, the production for the year from July 1, 1915 to June 30, 1916, was 37,301,944 tons, which is the greatest ever reported in a single year.

Of the iron made in 1916 there was 19,347,935 tons made with coke, 79,591 tons with anthracite and 191,996 tons with charcoal. Most of the anthracite furnaces use some proportion of coke mixed with the coal.

The production for the half-year, according to the grade of iron was as follows, in gross tons:

Grades	For Sale	For Maker's Use	Total	%
Basic	1,244,907	7,585,178	8,830,085	45.0
Bessemer and low phosphorus	801,592	6,037,585	6,839,177	35.0
Foundry, including ferrosilicon	3,037,646	48,764	3,086,410	15.7
Malleable	460,839	.....	460,839	2.4
Forge or mill	87,595	81,711	169,306	0.8
Ferromanganese	23,510	76,411	99,951	0.5
Spiegeleisen	74,886	14,209	89,095	0.4
All other grades	29,410	15,249	44,659	0.2
Total	5,760,385	13,859,137	19,619,522	100.0

Of the total iron made 72.7% was for makers' use and 29.3% was merchant iron for sale.

The production for the half-year by states was as follows, in gross tons:

	First Half of 1915	Second Half of 1915	First Half of 1916
Massachusetts and Connecticut	3,087	4,715	4,700
New York and New Jersey	921,566	1,183,214	1,214,037
Pennsylvania	5,199 421	7,591.247	8,286.076
Maryland	85,673	165,875	243,895
Virginia	105,244	146,102	202,777
Alabama	868,341	1,181,112	1,366,728
West Virginia, Kentucky and Mississippi	79,228	211,812	268 859
Tennessee	82,992	94,737	162,009
Ohio	2,964,211	3,948,751	4 250,790
Illinois	801,951	1,645 269	1,938,152
Indiana and Michigan	854,375	1,132,403	1,073.768
Wisconsin and Minnesota	130,514	242.452	417.542
Missouri, Colorado, Oregon	137,188	134,733	190,189
Total	12,233,791	17,682.422	19,619 522

The number of furnaces in blast on Dec. 31, 1915, was 310. On June 30, 1916, there were 344 in blast, leaving 102 idle out of a total of 446 stacks reported.

Frederick Folger Thomas

SPECIAL CORRESPONDENCE

In the death of Frederick Folger Thomas, which occurred at his residence, 2719 Dwight Way, Berkeley, Calif., on Aug. 6, the mining profession loses one of its most eminent members. His death followed an illness of only a few hours. He had been in San Francisco among his friends and associates on the day before, when he was suddenly taken ill, dying the next morning.

Mr. Thomas was a native of New York and was 73 years old. He graduated from Yale University with the Class of 1863. His first professional work was as assayer and chemist for the old Pittsburgh Silver Peak Mine at Blair, Nev. Two years later he returned to his Alma Mater as instructor in chemistry in the Sheffield Scientific School. Two years later he went to California to engage in his profession as a mining engineer. He was a familiar figure all along the Mother Lode of California, having been connected, in a constructing or advisory capacity, with practically every mine of note among the southern and northern mines of the Mother Lode. He was known in the profession as "The Father of Deep Mining on the Mother Lode." He opened the famous Trinity mine near Jackson, Amador County, Calif., but probably his greatest achievements were with the famous Gwin mine in Calaveras County and the equally famous Kennedy mine in Amador County, both of which he was connected with and financially interested in at the time of his death. It was while general manager of the Gwin mine, in association with David McClure, as superintendent, that he projected and successfully sunk the first vertical shaft on the Mother Lode. While others of the profession predicted failure, Mr. Thomas lived to see his work in this respect imitated at the other great mines along the Mother Lode.

In 1885 Mr. Thomas reöpened the famous Kennedy mine, and as a testimony of his ability that property has been successfully operated for 31 years.

Mr. Thomas was a pioneer at Jerome, Ariz., being connected with the United Verde Mine in its early days. He was also a pioneer in the copper mines at Ely, Nev. He was one of the first engineers to operate in the Broken Hill district of Australia. He was a man of sterling character, stanch and loyal to his friends and associates and of unquestionable integrity. Many friends mourn his loss. He is survived by his widow, Nora Peck Thomas, and five children: Frederick Folger Thomas, Jr., a prominent attorney of San Francisco; William Shepard Thomas, John Hudson Thomas, Maude Angeline Thomas, and Mrs. William C. Brady, of Berkeley.

Dust Losses in Copper Smelting

BY L. D. RICKETTS

In response to an inquiry concerning our Cottrell treaters, C. E. Mills, general manager of the International Smelting Co., at Miami, sent the following reply:

Plant consists of 1,008 13-in. by 16-ft. tubes, 240 over driers and 768 in a separate structure at converters. There are 10 General Electric transformers for 50, 75 or 100 thousand volts; 10 motor-generator sets with rectifiers on same shaft; 2 motor-generator exciters and necessary switchboards. The cost of this plant installed, excluding royalty and foundations, was as follows:

COST OF COTTRELL PLANT

Steel structure	$55,017.78
Motor-generator equipment	7,126.48
Switchboard	3,124.68
Transformers	10,667.17
High-voltage wiring	8,546.55
Low-voltage wiring	953.47
Cottrell tubes and shaking equipment	28,456.09
	$113,892.22

For the driers 45,000 cu.ft. of gas at 80° C. per ton of charge is produced. Tons of charge per 24 hr. is 1,100. The gas is handled by 200 tubes. The dust recovered by these treaters is not determinable, as it is collected with the dust that settles in flues. The total dust produced and recovered at this plant is 0.70% of dry charge treated.

About 270,000 cu.ft. of gas per min. at 150° C. is handled at the converter plant when producing copper at the rate of 300 tons per day; 2.3 tons of dust with 35% copper is recovered. To make the gas entirely colorless—that is, recover everything—it would be necessary to reduce the velocity in tubes to 3 ft. per sec. and cool to 80° C. This extra fume recovered would not have a commercial value.

Power consumption, average for three months, is 27,000 kw. per month.

Direct operating expenses per month are, for operating labor, power, supplies and expense, $1,188.79.

Voltage at treaters is from 50,000 to 60,000; current, about one-half ampere.

It is apparent that the loss of copper at this smelter from the Wedge furnace gases is nil, and the loss from

the converter stack is negligible. The reverberatory gases, after passing the waste-heat boilers, go to the stack without the intervention of dust chamber or Cottrell treater. As far as we can make out, the loss from this source—high because of our charging method—is about 0.185% of the total copper charged to the reverberatory.

The unaccounted loss is heavy, amounting to 0.7% of the total copper, or something over two tons of copper a day. Exceptional precautions were taken to provide tight cars, to unload under cover and to protect all belt conveyors and spreading beds from the wind. Mr. Wallace thinks much of this loss comes from two sources—from dust created in charging and discharging the calcine cars, and from dust blown into the air below the hoods in turning the converters down and up. The saving of this dust is most important, but the reverberatory and converter buildings cannot be tightly housed in on account of the health of the men. Possibly investigation along the line of using suction fans through hoods over points where the dust is made, with (possibly a settling chamber and) Cottrell treaters, would lead to a remedy for dust formed in charging and discharging the calcine cars.

If upon investigation it proves, as we think, that the loss from the converters is serious, it would seem an argument in favor of a long barrel converter with a discharge in one end, which would permit the taking of all gases through a smoke box without the introduction of much air and without a chance for the gas to be deflected through a wide angle away from the hood in turning the converters down and up.

When we have a market for sulphuric acid, such a converter would yield a very rich, hot gas, and therefore a gas giving the maximum weight of sulphuric acid per cubic foot of chamber capacity in an acid plant. This market approaches with the coming treatment of our oxidized ores.

The results that have been collected demonstrate that the electrostatic method of precipitating dust has come to stay. When I build new plants, even on such lean ores as Cananea produces, I shall not have a bedding plant in the open air, but will have such a plant completely housed in, with a separate building for each bed. Where possible, ores and mixtures should be handled under cover. They should not be allowed to drop through a space exposed to the wind.

If other large companies would compare our data with theirs and publish them in the *Journal*, it would be to the mutual advantage of all of us.

The Australian Zinc Producers' Association

The Zinc Producers' Association Proprietary, Ltd., has been formally registered in Australia. The nominal capital is £100,000 in shares of £1 each. These will be divided between the mining companies interested in proportion to their output of zinc concentrates over a term of years prior to the formation of the central organization. The names of the companies comprising the Zinc Producers' Association are: The Amalgamated Zinc (De Bavay's), Sulphide Corporation, Zinc Corporation, Broken Hill Proprietary, Broken Hill South, North Broken Hill, Block 10, Block 14, British Broken Hill, Junction North, Broken Hill Junction, Associated Smelters, Electrolytic Zinc Company of Australia, Mount Lyell, and the Burma Corporation.

The Australian output of zinc concentrates—estimated at from 400,000 to 450,000 long tons per annum—will be "pooled" upon the basis of the value of the concentrates produced by each company. For instance, a company which produces, say, a 49% zinc concentrate will receive a larger monetary return than a company producing a 46% zinc concentrate. The profits of the organization will be divided among its members—the companies mentioned—upon coöperative lines.

One of the articles of association provides that no person who is a subject of a country with which the British Empire is now at war shall at any time hold office as a director, manager or secretary, or shall be allowed to hold shares in the Zinc Producers' Association Proprietary, Ltd. The company will control the whole of the zinc concentrates output of Australia and the marketing of this product. Provision is also made for control over the treatment of the concentrates.

Rights Under a Void Lease

One who has developed mineral lands under a lease purporting to have been executed by a corporation owning the lands, but not authorized or ratified by that company, can be compelled to account to the corporation for the proceeds of ore sold from the land, according to the holding of the Arizona Supreme Court in the case of Franklin vs. Havalena Mining Co., 157 Pacific Reporter, 986. He is, however, entitled to have returned to him any payments called for in the lease and also amounts expended with reasonable necessity to preserve the title to the property while in possession; it appearing that he was ignorant of the fact that the lease had not been authorized by the corporation.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

STRAINER—Acid-Resisting Strainer for Smelters. Donald M. Cameron, Lowell, Mass. (U. S. No. 1,190,512; July 11, 1916.)

ZINC—Recovery of. Charles H. Fulton, Cleveland, Ohio, assignor to David B. Jones, Chicago, Ill. (U. S. No. 1,193,680; Aug. 18, 1916.)

EXPLOSIVE and Method of Manufacturing Same. Giovanni Spica, Venice, Italy. (U. S. No. 1,194,561; Aug. 15, 1916.)

FILTER. Charles D. Burchenal, New York, N. Y. (U. S. No. 1,194,949; Aug. 15, 1916.)

GRINDING MILL. John W. Cover, Tacoma, Wash. (U. S. No. 1,194,717; Aug. 15, 1916.)

GRINDING MILL. Thomas J. Lovett, Chicago, Ill., assignor to Copper Process Co., Chicago, Ill., a Corporation of South Dakota. (U. S. No. 1,194,757; Aug. 15, 1916.)

HYDRAULIC CONCENTRATOR or Classifier. Frank F. Wagner, Denver, Colo. (U. S. No. 1,193,953; Aug. 18, 1916.)

NICKEL—Recovery of Nickel From Its Ores. Henry Livingstone Sulman and Hugh Fitzalis Kirkpatrick Picard, London, England, assignors to The Madagascar Minerals Syndicate, Ltd., London, England. (U. S. No. 1,193,734; Aug. 18. 1916.)

ORE CONCENTRATOR. Louis David Chevalier and Henry Charles Reche, Dubuque, Iowa. (U. S. No. 1,194,477; Aug. 15, 1916.)

SEPARATION—Process of Separating Metals. Albert H. Sherwood, Oroville, Calif. (U. S. No. 1,192,945; Aug. 1, 1916.)

SILICO SPIEGEL—Process of Making Silico-Spiegel. Harry Schagrin, South Bethlehem, Penn. (U. S. No. 1,190,678; July 11, 1916.)

SODIUM AND POTASSIUM—Separation of. Harry P. Bassett, Catonsville, Md., assignor to the Spar Chemical Co., Baltimore, Md., a Corporation of Maryland. (U. S. No. 1,194,465; Aug. 15, 1916.)

STEEL—Process of Tempering or Hardening Steel. John B. Moore, Latrobe, Penn. (U. S. No. 1,190,937; July 11, 1916.)

TUNNELING MACHINE. William F. Wittich, Erie, Penn. (U. S. No. 1,191,864; July 18, 1916.)

Editorials

The Railway Situation

As we go to press this week, the railway situation remains unsettled, in spite of the intervention of the President. The developments of the last week have, however, sharply crystallized the issue and have produced a deadlock that can be broken only by one side or the other backing down, or so it looks. The position is substantially as follows:

The Brotherhoods—They have yielded in their demand for time-and-a-half overtime, but stand firmly on their demand for an eight-hour day. Failing to get that, they will strike.

The Railways—They have stated their willingness to submit the whole matter to impartial arbitration and abide by the result. The brotherhoods, however, do not want any arbitration. Heretofore they have been winners by arbitration, but now they feel sure that they have got the railways in the position of "hands up."

The President—He tells the railways to give the men the eight-hour day, which he considers to be a right of labor in modern civilization. He suggested the reference of some subordinate questions to a commission.

Thus the matter stands. The labor leaders retired to the background. There was no need of their remaining in the foreground, for the President of the United States had taken up the advocacy of their claims. The repudiation by the President of the principle of arbitration in industrial disputes drew out some adverse comments from the public, and in a subsequent communication he endeavored to smooth over that sacrifice of fair play.

It is ignored that the railway men do not really want an eight-hour day, but want an eight-hour day simply as a basis of payment. In other words, they are asking for an advance of 20 to 25% in wages under the guise of demanding an eight-hour day. The railways say they cannot stand it unless they are permitted to increase rates, as to which they have no assurance. Upon a former occasion when they requested of the Interstate Commerce Commission the right to raise rates on the ground that they had been obliged to advance wages, the commission told them in effect that they had no business to do so; that in doing so they took all the risk, had no reason to look for indemnification at the expense of the public, and could not have it.

Throughout this labor dispute it has looked until lately as if the public would be the goat—that is, the men would be granted their increase and the Interstate Commerce Commission would be inspired to permit the railways to raise rates as part of the deal. The present outlook is that the railway stockholders will be the goat. If the engineers, conductors, firemen and brakemen obtain what they want, somebody has got to pay for it. That somebody is either the public or the stockholders. According to the modern theory of class legislation it will be quite in order to put the burden on the stockholders, for they are fewer in number than the public.

Revision of the Mining Law

The memorandum outlining some main points for a revision of the mining law of the United States that was adopted by the New York section of the Mining and Metallurgical Society last spring has excited a good deal of discussion. In the main the criticisms have been directed toward details rather than toward principles. As for the latter, the adverse comment appears chiefly to be that what is proposed is nothing but patchwork legislation. That will be conceded by everybody. With things as they are, probably nothing but patchwork is possible. The most important thing is to have good patchwork. Everybody knows how the present laws work and appreciates certain serious defects in them. It will be undoubtedly far better to correct those defects and repair things generally than to throw away the old machine and try something of an entirely new design, as to which nobody can know how it is going to work until it has been tried.

We do not think, therefore, that it would be advisable to contemplate the introduction of any new principles of sociology or welfare, such as governmental retention of mineral rights, a leasing system, a segregation of surface rights and mineral rights, or any experiments of such kinds. Most of those systems are in effect in other countries, but it ought to be borne in mind that in general the other countries grew up with them, that conditions abroad are different from what they are in the United States. It is well to bear in mind also that after the Louisiana Purchase the United States came into possession of important areas of lead-bearing lands in the Mississippi Valley, that ownership thereof was retained by the Government and a trial of their exploitation by a leasing system was made. After more than 40 years of this, during which time the system proved to be a miserable failure, Congress in 1847 decided to sell the national lead lands in the Mississippi Valley. On the other hand, the great mineral wealth of the region west of the Rocky Mountains has been successfully developed by the present system, and it will be best, without any doubt, to preserve that system.

Moreover, it ought to be remembered that since 1872 our existing mining laws have been the subject of a great deal of litigation. That very fact is a prime reason why they ought to be amended. On the other hand, that litigation and the court decisions have in the main established a precise understanding of the language of the present laws, the principles of their administration, etc. It would be foolish to throw away the wealth of legal definitions that have been obtained at such great cost, and substitute a new language—a new phraseology—that would have to be interpreted all over again. We think it is a sound argument that the principles, the phraseology and the practice of the present laws ought to be preserved to the maximum possible extent.

With regard to principles there are three fundamental ones that ought to be changed. As to this, mining men appear without any doubt to be substantially in agreement.

There is a consensus of opinion that extralateral rights ought to be abolished in so far as claims hereafter located are concerned, that discovery as a prerequisite to location ought to be abolished, that the performance of annual assessment work ought to be regularized, and that there ought to be a means of appeal from decisions of the General Land Office. There is another principle that ought to receive more consideration than it has heretofore. This relates to the scope of the mining law. It was the intention of the framers of the existing laws to have them cover all kinds of valuable mineral deposits other than coal, but that manifest intention has been defeated to a greater or less extent by decisions of the General Land Office. In enacting a new law, if the intention be to have it cover all classes of valuable mineral deposits other than coal, that intention ought to be defined so clearly that there will be no misunderstanding of it.

While there is a general agreement that the prerequisite of discovery should be abolished, there is not an agreement, or perhaps we should say not a good understanding, as to how that may be effected. If the discovery prerequisite is to be abandoned, there must be some restriction upon prospecting rights, for the Government would probably not permit indiscriminate location.

1. A simple form of restriction would be that (*a*) the new law authorize mineral locations *without discovery* in any part of the public lands officially classed as mineral; (*b*) that the new law authorize mineral locations *upon discovery* in any part of the public lands whether officially classed as mineral or nonmineral. The second provision would preserve to the prospector every right that he has now. The first would give him rights that he has not now, but ought to have. By the second provision the prospector might go upon a forest reserve, and if he found there a valuable mineral deposit, he might locate a claim upon it and hold it as long as he did the legal assessment work.

Other debatable questions pertain more to matters of detail. Some of those that have been raised are the following:

2. Shall mineral claims hereafter located be 660 ft. square; that is, 10 acres in size and square in form?

3. Or shall they be 1,320 ft. square; that is, 40 acres?

4. When the proposed square claims are located on surveyed land, shall they be required to be subdivisions of the surveyed sections?

5. If not located on surveyed land, shall it be required that the boundaries run north and south and east and west?

6. Shall the number of claims locatable by one person or association be limited or unlimited?

7. If limited, what shall be the limit?

8. Shall existing regulations concerning the marking, notice and record of location be continued?

9. Shall there be the additional requirement that one year after the date of location, record thereof shall be made in the United States Land Office of the district?

10. Or shall the time allowed for recording be more or less than one year?

11. Shall the annual assessment work be at the present rate—$100 per 20-acre claim, or $5 per acre?

12. Shall it be provided that an equivalent sum of money *may* be paid into the United States Land Office in lieu of the performance of assessment work?

13. Shall a person or association holding a group of contiguous claims be permitted to do the assessment work upon one claim and thereby hold the group, the amount of such work to be equivalent to $5 per acre for each claim of the group?

14. Shall a person or association doing assessment work in any one year to the value of more than $50 per 10-acre claim be given credit for the excess in succeeding years, provided, however, that no fractions of $50 shall be considered for this purpose? (If the claim unit be 40 acres, these figures would be raised to $200.)

15. Shall it be provided that in performing assessment work labor shall be reckoned at the current rate of wages for miners in the district? Or at some other rate; and if so, what?

16. Shall it be required that every holder of a claim shall file annually a record of his assessment work, accompanied by vouchers, in the Land Office of the district?

17. Shall proceedings for patent remain as now?

18. Article V of the memorandum adopted by the New York Section reads as follows:

> Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter to have the exclusive right of possession and enjoyment of the surface held by him and of the minerals under it, bounded by vertical planes passing through surface boundaries of said land, but not the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located to have similar exclusive possession of all the mineral in said claims that is not covered by any existing extralateral rights.

The article mentioned abolishes extralateral rights in so far as any claims hereafter to be located are concerned. The extralateral rights of existing claims may not be taken away, however, wherefore any new location and grant of patent may be made only with the reservation of such rights. The rights of existing claims having been thus expressly preserved, the last sentence of this article confers upon previously located claims the rights to everything comprised within the vertical projection downward of their side lines that is not legally claimed by anybody else, this being thus an addition to the original extralateral rights. This article has received general approval with scarcely any criticism.

19. Shall notice of location of all mining claims, hereafter made, be filed for record in the Land Office of the district within one year after date of location? Shall the time be more or less than one year; if so, what?

20. Shall it be provided that final entry and payment be made for such claims within seven years after date of location, exclusive of the time covered by pending adverse claims? Shall the time allowed for this purpose be more or less than seven years; if so, what?

21. Shall the new law provide for appeals from decisions of the General Land Office to a court of competent jurisdiction?

A good many of the foregoing points are not vital. Some of them are just as they are now, namely, Nos. 6 and 13. Others suggest the retention of present provisions, as Nos. 8, 11 and 17. One very important matter in our judgment pertains to the size and shape of claims and the method of laying them out. There seems to be a unanimity of opinion in favor of square claims. There is strong opinion in favor of laying them out in coincidence with the lines of surveyed land, but north-south and east-west anyhow. This is to avoid the crazy-quilt confusions of our existing mining districts. If such a plan be

adopted, it will be impracticable, or anyway very undesirable, to have claims larger than 10 acres. On several grounds the 10-acre unit seems to be the best.

It is hoped that these matters will receive very full discussion. We invite our readers to express themselves specifically with respect to the 21 questions that have been formulated herein.

BY THE WAY

If the high price for print paper leads to an abolition of the Sunday supplement of the daily press, it will not be an unmitigated evil.

The Tom Reed Gold Mines company hereafter will supply water to its former patrons in Oatman. It has been advised by the Arizona corporation commission, according to the *Mojave Miner,* that it is its legal duty to do so. This is regardless of the fact that it must have additional water for its extra ten stamps at the mill. The company will have to get water from some new source to fill both of these pressing demands.

The Chicago *Tribune* vouches for the following sign in a hotel in Miami, Ariz.: "When the handles are off the faucets, it means that the water is not to be used. The landlady will provide baths on Saturdays and Sundays. Use no wrenches." After which the garrulous *Tribune* editor says of a recent experience there. "My sister, had said, 'You will be crazy about Arizona,' so I wired her from Miami this message: 'We were just about to be crazy over Arizona when we found two hairs in the soup.' The telegraph operator smiled when he ran his eye over my offering. 'Say, that's the first code message ever went through this office!' said he."

A long, hungry, green-looking, young Texan had been hanging around the repair shop of an Arizona mine for several days looking for a job. The repairman at last got tired of the drawl and the family history of the boy just from home, so he told him there was a job on the "pipe stretcher" in the machine shop, and suggested that he see the machine-shop foreman about it. The foreman, who hated himself and everybody else, particularly that repair man, when the Texan spoke and told him who had sent him for the job on the pipe stretcher, let out a bawl that would make a bull jump into the sump and said that the machine would not be ready for a few days. The young Texan was game and said he would like to have something to do until it was ready. The foreman did not want a common repair man to have anything on him, so he gave the boy a requisition and told him to go to the warehouse and get a bucket of "striped paint" and come back and he would put him to work. He went to the warehouse, but that was the last seen of him.

Benjamin F. Atherton, of Portland, Ore., is offering the following:

MINING PROPOSITION

The Rand Mine, South Africa, duplicated in Oregon—with this difference—it is close to two railway lines—can be electrically operated—plenty water—no clay to contend with, rock already crushed and pulverized. Four thousand acres—a steam-shovel proposition. The stratas are over 20 mi. long, 5 to 7 mi. wide and of unknown depth. Prospecting of 1,670 ft. in well shows no solid formation. The stratas are of black sand interlaid by conglomerate mineralized matter. Engineers say, that practically all of the Royal Group of Metals are represented—60% being Zircon. Concentrates run from $1 by cyanide process to an average of $40 by using our secret process of recovery, although some returns have gone to $90 per ton and over.

Consider this: Engineers say each 20 acres contain 1,000,000 tons concentrates. Cyaniding will give $1 per ton—Our Process will average $40 per ton—and one of our machines complete of 100 tons capacity will not cost over $25,000.

THIS IS A GILT-EDGE INVESTMENT

The company or individual who has the capital to invest in this mining proposition and also the purchase of this secret process—although they may license it—will double and treble their money in a very short time—receiving continuous returns. We are prepared to back our statements, have machine ready—you take Pullman car in morning—go upon the property—obtain your samples—return to Portland in the evening and make your test—satisfy yourselves. Then if you mean business, we will get down to facts.

A professor of mining in a well-known college who received one of Mr. Atherton's letters thought that it was rather cheeky, for college professors are not by any means an easy lot. For our part we find several of Mr. Atherton's ideas to be interesting. We wish only that we could take a Pullman car in the morning, find out if they are true and get back by evening.

For the first time in its history of 45 years the American Institute of Mining Engineers will next month meet in the State of Arizona. The sessions will extend over the entire week of Sept. 18-23 and will be held in the principal mining centers of the state, the members traveling between the various points by special train and automobile. Principles of mining and metallurgy of the greatest interest will be presented at the technical sessions. A special train has been arranged for to carry Eastern members from New York on Sept. 14. Other members and their guests will join the party at various points en route, and at El Paso, Tex., the Western section of the convening members, starting from Los Angeles, Cal., will meet the train and continue to Arizona. The principal towns in which the Institute sessions or visits of inspection will be held are Santa Rita and Hurley, N. M., and Douglas, Bisbee, Globe and Phœnix, Ariz. The inspections will include the Roosevelt Dam and the mines and works of practically all the leading metal-producing companies of the state. At Douglas, in the technical sessions, the Institute will discuss the special subject of "Smelting." At Bisbee papers will be read on "Mining and Geology" and at Globe the first day will be given over to "Mining and Smelting" and "Leaching." During a second day at Globe time has been set aside for what is regarded as an important discussion of "Concentration and Flotation." The company plants that will be visited are as follows: At Hurley, the mines and works of the Chino Copper Co.; at Bisbee and Douglas, the mines and works of Copper Queen Consolidated Mining Co., Calumet & Arizona Copper Co. and Shattuck Copper Co.; at the Globe District, mines and works of Inspiration Consolidated Copper Co., Miami Copper Co., Old Dominion Copper Mining and Smelting Co., together with the new works of the International Smelting Co.

An elaborate entertainment program is being planned by the Arizona Committee comprising Gerald F. G. Sherman, Arthur Notman, secretary, Norman Carmichael, W. G. McBride, John C. Greenway, W. L. Clark, B. Britton Gottsberger, and Forest Rutherford.

PERSONALS

P. K. Lucke has gone to Cuba and Costa Rica on mining business.

Charles E. Dutton, of Goldfield, Nev., has gone to New York and Boston on business.

Charles Hayden is expected in New York next Monday, returning from his Alaskan trip.

Dr. G. H. Cox and **D. H. Radcliff,** have opened offices in Tulsa, Okla., as consulting geologists.

F. G. Moses, is erecting a flotation plant at Superior, Ariz. for the General Engineering Co., of Salt Lake City.

E. A. Cappelen-Smith has been visiting the mines and smelters at Butte, Mont., with which he was formerly connected.

Wallace Lee, formerly with the Geological Survey, has joined the geological staff of the Cosden Oil and Gas Co. at Tulsa, Okla.

R. E. Cranston left San Francisco, Aug. 11 for an extended trip into Nevada, Colorado and Montana, on professional business.

Daniel Moran, of New York, and associates have been examining molybdenite properties near Amos in the Hurricanaw district in Ontario.

George H. Heitz, Colorado School of Mines '06, has moved from Denver to Leadville and is associated with the firm of Platt & Kleff, mining engineers.

Thomas A. Stroup has left the engineering staff of the Tennessee Copper Co., and is now engineering assistant with the Utah Copper Co. at Salt Lake City, Utah.

Horace Albert Scott has been elected instructor in geology and mineralogy in the Missouri School of Mines to succeed W. L. Dobie, who has resigned to go into practical mining.

Geo. H. Garrey who has spent the past six months on examination work in the Western States and British Columbia was at his Philadelphia office for a few days the past week.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, has gone to Montana to investigate the system of mining taxation in connection with the work of the Ontario Nickel Commission.

Samuel D. Nicholson, manager of the Western Mining Co., operating the Wolftone mine in Leadville, has received the nomination for governor by the Colorado Republican state assembly.

John W. Finch has gone to China to make investigations for an important New York syndicate that contemplates making extensive mining explorations and developments in China and Siberia.

Martin Schwerin has been for two months at Leadville, Colo., making a geological study for the Yak Mining, Milling and Tunnel Co., and has now returned to his office at 42 Broadway, New York.

George R. DeBeque who has been managing mines in Mexico for several years recently returned to his home in DeBeque, Colo., after a narrow escape from execution at the hands of Mexican military officers.

John R. Champion, pioneer Leadville mining man, superintendent for the Yak Mining, Milling and Tunnel Co. for twenty years, has resigned. He will be succeeded by Hugh C. Watson, formerly assistant superintendent.

F. G. Clapp and **M. L. Fuller,** managing engineers of the Associated Geological Engineers, have been investigating properties in Kansas. The latter has returned East, while the former has gone to Duncan, Oklahoma.

H. K. Najarian has taken a position with the firm of Bradley, Bruff & Labarth, of San Francisco. He was formerly with the Nevada Consolidated Copper Co. He is now at the new works of the Missouri Cobalt Co., Fredricktown, Mo., engaged in smelter designing.

Garrett A. Mullenburg, for the past year instructor in geology and mineralogy in the Colorado School of Mines, has been elected instructor in geology and mineralogy, in the Missouri School of Mines to succeed D. H. Radcliff, who has resigned for the purpose of going into practical work as an oil geologist in Oklahoma.

James MacNaughton, general manager and vice-president of the Calumet & Hecla Mining Co., is to take up his residence in Boston, Dec. 1. He will continue to manage the company. **John Knox,** superintendent, will take care of considerable of the work at the mine. Mr. MacNaughton will be a frequent visitor to the copper country and there will be no change in the titles of the two men.

F. J. H. von Engelkeng, of Florida, has been chosen by the President to succeed Robert W. Woolley, of Virginia as director of the Mint at Washington. Mr. Woolley resigned to become the director of publicity of the Democratic National Campaign. Mr. von Engelkeng has been an interested worker in behalf of the enactment of a Rural Credits law. He was chosen by the Southern Commercial Congress to serve with its commission in the study of the subject abroad.

Walter A. Barrows, Jr., of Brainerd, Minn., has been elected president and general manager of the Thomas Iron Co., Easton, Penn., to succeed Ralph H. Sweetser, whose resignation of several months ago becomes effective Aug. 31. Mr. Barrows has had an extended experience in blast-furnace and iron-mining work. He was for several years general manager of the Shenango Furnace Co., and for five years past has been engaged in iron mining and exploration in Minnesota.

OBITUARY

Matthew Jacobs, mining man of San Francisco, and father-in-law of Superior Judge Franklin K. Griffin was instantly killed Aug. 15 near Hopland, Calif., in an overturned automobile. R. V. Montgomery, mining partner of Jacobs, and H. M. Anthony, attorney, who were in the machine, escaped uninjured. The party were going into Lake County to examine mining property. Jacobs was 51 years old and a native of Minnesota.

Edward Gere Denniston died at his residence at San Francisco, Calif., on Aug. 7. Mr. Denniston, who was about 75 years of age at the time of his death, was one of the pioneer manufacturers of San Francisco. In 1865 he established the San Francisco Plating Works which has been one of the principal sources of supply for copper plates for mining uses ever since its establishment. Mr. Denniston is said to have been the first American manufacturer of silver plated copper plates for saving gold.

Campbell Douglas Whyte is reported to have been killed in action in the European War, supposedly in the last part of July or the first part of August. Whyte was a metallurgical chemist who went to California in 1905 from Edinburgh and was employed at the Golden Jubilee mines in Trinity County. Later he was connected with the Santa Cruz Cement Co. in California. At the outbreak of the war, he sailed for England and joined the London Fusileers. He had just been recommended for a commission prior to his death.

Captain Martin Goldsworthy, mining captain at the Chapin mine, Iron Mountain, Mich., for the Oliver Iron Mining Co. for a great many years, died Aug. 16. He worked at the property for 34 years, being in charge of the underground work the greater part of that time. The Chapin is one of the largest underground iron ore properties in the Lake Superior district and has often shipped over 1,000,000 tons in a single season. Captain Goldsworthy was 68 years of age. He was retired on a pension a few months ago and failed rapidly after giving up his work. He was well known throughout the Lake Superior district. He leaves a widow and three children. Interment was in Iron Mountain.

Ralph D. Williams, editor of the "Marine Review," Cleveland, from 1900 to 1915, died Aug. 14, aged 48 years. He was born at Nottingham, England, and when he was about 10 years old his family removed to Cleveland. He was successsively reporter on the Cleveland "Plain Dealer," city editor, managing editor and Washington correspondent, resigning in 1900 to become editor of the "Marine Review." Ill health compelled his retirement in June, 1915. He was an authority on statistics and history of the Great Lakes trade, and much of this information he embodied in a biographical book, "The Honorable Peter White," published in 1907, a real contribution to the history of the Lake Superior iron ore region.

TRADE CATALOGS

Steam and Electric Shovels, Placer Dredges, Etc. Bucyrus Co., South Milwaukee, Wis. General Catalog No. 15. Pp. 40; 6x9 in. Illustrated.

Denver Fire Clay Co. has issued a special catalog of Case metallurgical furnaces, showing their adaptability for melting, refining, assaying, temporary and other uses about the plant. The furnaces themselves and special installations are described.

Editorial Correspondence

SAN FRANCISCO—Aug. 17

General Petroleum Corporation, newly organized, has secured a permit from the Commissioner of Corporations to issue its stocks and bonds, and official approval of the reorganization of General Petroleum Co. in accordance with the plan worked out by the protective committee composed of Frank B. Anderson, Herbert E. Clayburgh, Mark L. Gerstle, Joseph E. Grant, John D. McKee, Maxwell McNutt, Philip I. Manson, Percy T. Morgan and Richard Mulcahy. The effect will be to reduce materially fixed obligations of the company and prevent a foreclosure of the mortgage on the property of the General Pipe Line Co. The property taken over by the new corporation has an approximate value of $27,500,000.

Chromic-Iron Production in California made a remarkable advance in the first half of 1916. Production in the six months is estimated by the U. S. Geological Survey to be three times greater than the annual production of former years. According to the Survey figures, the average annual production for the last 35 years, 1880-1915 inclusive, was 1,229 tons, while the output in the first six months of 1916 is estimated at 3,687 tons. The Survey figures for the several years of the 35-year period are not at hand, and though the U. S. Geological Survey and the California State Mining Bureau do not always agree in statements of production of minerals and metals in the state, such figures as are at hand from both sources may here be used in showing the fluctuation in output of chromic iron for the period named. In the first seven years, 1880-1886, the average annual production increased; in the following nine years, 1887-1895, the average increased to 2,864. The largest production in this period was 3,680 tons in 1894, which decreased to 786 tons in 1895. The succeeding three years there was no production recorded by the Mining Bureau; according to the same records in the 12 years, 1900-1911, the average annual production was only 332 tons. In the last four years the production was as follows: 1,270 tons in 1912, 1,180 in 1913, 1,517 in 1914, 3,800 in 1915, or an average of 1,943 tons a year. The Survey uses long tons and the Mining Bureau short tons in computation, so that the averages here given (in short tons) may be considered approximations. But the variance between the two reports for 1914 is not reconcilable to the difference in the long and short ton. Mr. Diller's report in "Mineral Resources" for 1915 states that "the production of chromic iron in 1915 amounted to 3,281 long tons, valued at $36,744, a gain of 2,690 tons and of $28,029 over 1914", which reduces the 1914 production to 591 (long) tons valued at $8,715. The Mining Bureau (Bull. 70) gives the 1914 production as 1,517 (short) tons, valued at $9,434. The Bureau returns are not yet available for 1915. Mr. Diller's report shows an average value per (long) ton of $11.19. In the present year numerous old and new chrome properties were opened and it is probable that some of them will remain in permanent operation. The production in 1914 all came from Shasta and Calaveras Counties. In 1915 these counties increased their output and several other counties helped increase the total. The principal counties mining and shipping chromic ores in the first half of 1916 were Amador, Butte, Calaveras, Eldorado, Fresno, Glenn, Shasta, Siskiyou and Trinity.

Butte—Aug. 18

Anaconda Has So Much Zinc Ore developed in the Emma and other mines that it is not in the market for any more zinc properties, and has allowed its option on the Czarromah and Travonia Fraction to lapse. The company has developed enormous reserves of zinc ores in the upper levels of some of the copper mines in the Butte district and is also making a big zinc mine of the Douglas, a property in the Coeur d'Alene district of Idaho, which it purchased some time ago on a basis of 30c. per share for the stock of the Douglas company. Anaconda has begun mining in the Emma and the showing in that and its other properties indicate a reserve that will meet all demands for many years. The option on the Czarromah and Travonia was secured last winter shortly after the company made the deal on the Emma. The option price on the Czarromah and Travonia Fraction was $300,000 and it is understood that $50,000 has been paid to the Dickerman brothers, of Duluth, on the option. What the Dickermans will do with the properties is not known, though it is stated that they have had several other offers to take them under option. The Anaconda company could operate the claims much more economically than any other concern or individuals can, and probably no one else could afford to pay for the claims what the Anaconda company was expected to pay for them.

DENVER—Aug. 17

Arrest of Edward Tankersley, a Denver broker, suggests that wildcatting is still a factor with which legitimate mine promoters must contend. He is charged with crooked dealings pertaining to a Boulder County tungsten property. Business men of Boulder propose to see that this case is vigorously prosecuted.

Reopening of the Victor Mine, once a prominent property in the Cripple Creek district under the ownership of the Moffat-Smith syndicate, is now to be undertaken by Colorado Springs and Cripple Creek operators. The mine has not been systematically worked since 1899. It is credited with a gross production of $2,216,671 of which $1,155,000 was distributed as dividends. The Isabella, another Bull Hill pioneer mine, recently shipped 21 tons that were settled for on the basis of a gold content of 3.98 oz. per ton, while a carload lot of screenings contained 5.45 oz. gold per ton.

Boulder County's Tungsten Boom has subsided, but it is being succeeded by conditions that promise much for the near future. Tungsten mining has not ceased by any means but, instead of there being the feverish rush to organize new companies to dispose of ore at inflated prices, miners are producing ore in more systematic fashion and realizing fair profits on the normal market. The tungsten excitement brought many investors into the county and several of these men have taken hold of gold and silver properties which, under new development, are showing up well. The Yellow Pine and the Logan mines at Crisman have been taken up by a group of men styling themselves "The Lucky Seven" and have recently disclosed rich shoots of ore, the former in silver and the latter in gold. At Summerville, the Little Fred mine is being put into shipping shape, while the nearby Victoria mine, a pioneer silver producer, is being unwatered preparatory to renewed operation.

SALT LAKE CITY—Aug. 18

Unsurveyed Public Lands in Utah, according to the annual report of I. C. Thoreson, U. S. surveyor general for the district of Utah, aggregate 21,131,714 acres, as compared to less than 2,000,000 acres of unsurveyed lands in Colorado and an approximately equal amount in Wyoming. The total surveyed acreage in Utah at the close of 1914-1915, was 32,498,375 acres, to which a total of 756,286 acres was added during the year just closed making total acreage thus far surveyed 33,254,661 acres. The total acreage of the state is 54,386,375. In the mineral division, deposits received were smaller than during the year preceding—this being accounted for by the fact that advance deposits for office work were reduced last February from $30 to $20 a location. Employees in the field division of the General Land Office have been given a flat increase in pay of $10 per month.

The Iron Blossom Tax Dispute between Juab and Utah Counties over the tax on the net proceeds of the mine which covers ground in both counties, is now in the hands of the state board of equalization. According to a survey made by the county surveyor and placed before the board by two commissioners of Juab County, it appears that Juab County is this year entitled to approximately 80% of the tax money. The survey of the stopes from which ore was mined shows these to have been largely in Juab County. Utah County's claim for a large part of the Iron Blossom tax was based on a map in which there was an error in the location of the boundary line between Utah and Juab Counties. The Supreme Court in a recent ruling holds that the tax on the net proceeds of a mine must be paid into the county from which the ore is mined, notwithstanding the fact that the portal of the tunnel or the shaft through which the ore is brought to the surface may be in another county.

CHLORIDE, ARIZ.—Aug. 16

Chloride Is Growing Steadily in activity, though the camp shows no signs of a "boom" as it is generally known in the West. Considerable development is being carried on in a quiet way and the district is gradually getting away from the early-day surface mining, more attention now being paid to developing ore reserves at depth. Aside from the Tennessee

mine of the U. S. Smelting, Refining and Mining Co., practically all the mining in the past has been done at a depth of not over 200 or 300 ft. The exceptions are the Schuylkill and the Elkhart, the shafts of which are down about 500 ft.; both claim good ore at that depth and are being unwatered for deeper development. It is difficult to estimate the number of men employed in the district. There has been no inrush of unemployed but the operators seem to find no difficulty in getting men. Business in the town has been steadily improving. The summer months are usually dull in this part of Arizona although Chloride has almost an ideal summer-resort climate. A concrete-block building is just being completed for the Arizona Central Bank, and another is being erected for a drug store. A new and surprisingly good restaurant was started about six weeks ago, and altogether the camp shows an air of prosperity without feverish excitement which promises well for its future development.

TUCSON, ARIZ.—Aug. 13

The Arizona Federation of Labor in annual session at Tucson, Aug. 12, endorsed the candidacy of Governor Hunt and adjourned. The meeting was favored with a good deal of foreign talent. "Mother" Jones, who was sent by the Western Federation of Miners to help Hunt, vehemently fulfilled her mission. Olaf Tveitmoe, of San Francisco, who came, as he stated in his address, to speak for Hunt and to gather funds for one Schmidt and one Caplan who are on trial for murder in connection with the dynamiting of the Los Angeles Times Building, got over $600 from the laboring men and departed. On report of Member John L. Donnelly, of Morenci, that serious trouble in that district was hardly averted when the sliding scale slid downward to the tune of about 25c. per day per man—the Mexicans and Spaniards believing the company managers arbitrarily fixed the price of copper—the Federation forwarded to the Secretary of Labor at Washington a resolution asking an investigation as to the manner in which the average monthly price of copper is ascertained. It then sent word to the boys not to strike till it finds out precisely who sets the price of copper. The organization resolved against the "home guards," formed throughout the state at the approach of hostilities between United States and Mexico, seeing in them a menace to organized labor. The Morenci Mine, Mill and Smeltermen's Union reported as grievances that the managers will not give them ground for a union-hall site and that too much diagnostic importance is given the cerebrations of strong union tendencies in a possible employee by the company surgeon, in ascertaining the fitness or unfitness of the applicant.

ROSICLARE, ILL.—Aug. 16

Operations Resumed at Rosiclare Lead and Fluor Spar Mines on Aug. 14, after being idle since July 15 on account of labor troubles. Fairview Fluor Spar and Lead Mine is making preparations to start work again about Sept. 1. The Kentucky fluorspar mines were not affected by the labor disturbances and have been producing their normal tonnage.

FLAT RIVER, MO.—Aug. 17

Much Diamond-Drill Prospecting is now being done by all companies, and it is the general belief among the mining men that new deposits will soon be opened in the district. In the vicinity of Valles Mines, 8 mi. north of Bonne Terre, small pockets of rich zinc ore are being opened. These prospects mine an average of 10 tons each, daily.

A New Steel and Concrete Mill is being built by the Federal Lead Co. at Elvins. The construction is practically completed, and machinery is now being placed. During the last of July four Hancock jigs were installed. The mill is expected to be operating by Jan. 1, 1917, and will be capable of treating 2,500 tons of ore per day. This is the only mill in the district that has a natural sloping base. Mining men are looking for a new cost record to be established as soon as the mill is in good working order.

JOPLIN—Aug. 19

Labor Troubles at Henryetta, Okla., continue to handicap the smelting plants. There has been a strike on at one smeltery for over a month, the men demanding that the owners recognize the Western Federation of Miners. As a result, only one block of this plant has been operating. A fusilade of 60 shots was fired in the neighborhood of this plant last Monday morning, but no one was injured. The Picher Lead Co.'s new smelting works at this place is virtually completed but it will not be started until labor conditions are quieter.

Zinc Smeltery will be built or purchased by the Lincoln Zinc and Smelting Co., according to an announcement just made. Roland R. Conklin, of New York, is chairman of the board of directors of this company, which at present owns the Ethel Gray, the Mary C., the Seneca and Roland mines in this district. Jesse Briegel, who has been in charge of the mines, is the company's representative for Missouri, and O. A. Sneed, a well-known local operator, will have charge of operations. The corporation is chartered by the State of Delaware and executive offices are at No. 1 Wall St., New York.

HIBBING, MINN.—Aug. 19

Dynamiting Outrages on the Mesabi are alienating the sympathies of practically all residents, outside the regular members of the Industrial Workers of the World. On the night of Aug. 16 unknown parties dynamited a boarding house in Biwabik, where a number of miners who had refused to join the union were living. The front part of the house was blown to atoms, but fortunately no one was injured. The same night the home of a hoisting engineer at the Nelson location, near Hibbing, was partially destroyed by the same method. Officers are making a rigid search for the criminals and hope to be able to land them in jail. It is getting to a point now where the leaders of the I. W. W. realize that their case is getting desperate and they are resorting to any means to further their cause. It is thought that it will not be long before the strike on the Mesabi will collapse. There would be no sense in continuing the strike during the winter months when all of the pits and many of the underground mines are idle. It is already known that many of the underground properties will not be opened again until next spring, even if the strike should be called off today. The demonstrations on the Cuyuna range did not last long as the men soon realized that they had been duped by agitators. The Clark and Chester mines on the Mesabi resumed operations this week. The Tioga, which started two weeks ago, is now working with two full crews. August shipments from the Mesabi range are expected to be in excess of 10,000,000 tons.

WINNIPEG—Aug. 16

New Mining Areas in Manitoba, north of The Pas, have been visited recently by Marvin Allen, provincial engineer of Manitoba, and also by Prof. R. C. Wallace of the University of Manitoba, and it is stated that their reports will be decidedly favorable. American interests (the Clark-Stone Co., a subsidiary of Hayden, Stone & Co., of Boston) have been drilling the copper deposits discovered about a year ago by Jack Hammill, a well known northern Ontario prospector. The purchasers were to do 5,000 ft. of diamond drilling, to construct railway, smelting and water-power plants and to produce ore within five years from last January; a payment of $500,000 is to be made Jan. 12, 1917. The first portion of the contract for diamond drilling in the vicinity of Flin Flon Lake has been completed and indicates a deposit having a depth of 250 ft. and a width of 200 ft., containing about 2% copper and a good amount of gold; also some showings of zinc and silver. Some high-grade ore has also been opened. This new copper area is about 110 mi. northwest of The Pas, near the eastern boundary of Saskatchewan in the vicinity of Flin Flon Lake, Schist Lake and Lake Athapapuskow. At Schist (or Amisk) Lake, 3 mi. south of Flin Flon, the Tonopah Mining Co. has had one diamond drill operating on a copper deposit higher in grade than the Clark-Stone operation, but containing less gold. The ridge along which these deposits are situated extends for about 125 mi. and is from 10 to 20 mi. wide. At the southeastern extremity near Herb Lake, Hon. Hugh Armstrong, of Portage la Prairie, formerly provincial treasurer of Manitoba, and associates have been developing gold claims.

In the Gold Lake Section of the Rice Lake district, renewed activity is promised by the incorporation of the Manigotagan Mining and Development Co. to operate the Moose and nine other 50-acre blocks. This company has offices in Winnipeg and at 35 Wall St., New York, Frederick G. Corning, J. S. Bache and other New Yorkers having joined the directorate. The Moose shaft is down 100 ft., where about 200 ft. of drifting has been done under the direction of John Reddington, formerly of Cobalt. Henry Cecil, of Haileybury, Ont., and 25 Broad St., New York, who promoted the Manigotagan, is also planning a new organization, the Gold Pan Mines, Ltd., to operate the Gold Pan, Gold Pan Fraction, Gold Seal and Sunlight claims. On the Gold Pan claim, "jewelry ore" has been found more or less all the way down the shaft but especially from 108 ft. to the bottom, 125 ft., where a 15-ft. drift is still reported in the ore; the other shaft on this group is on the Gold Seal claim, 55 ft. deep with a drift 45 ft. on a 5-ft. vein. No work is being done on this group and shafts are battened down but it is expected that New York men may take an interest in the exploitation of this group. Boulder Gold Mines, Ltd., has acquired the Lucky Strike claim and Gold Seal Mines, Ltd., has been organized to develop ground southwest of the Gold Seal claim. The Gold Lake district is about 120 mi. northeast of Winnipeg and about 30 mi. from the Ontario boundary. It is reached by boat from Selkirk to the mouth of the Manigotagan River, thence by canoe practically to Gold Lake; however, from Manigotagan to Clear Water Lake, about 48 mi., numerous portages must be made.

The Mining News

ALASKA

FIRST COAL TRAIN from the Matanuska field over the Government's railroad was taken from Goose Creek, Aug. 16, to the harbor at Anchorage.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Reported will sink another working shaft, 1,800 ft. deep, with five compartments, in the flat between Bakersville and Cochise siding; new shaft will facilitate development, ventilation, pumping and perhaps the larger part of the ores from the Briggs and Junction country will be hoisted through it; will be concreted from top to bottom.

Gila County

ARIZONA COMMERCIAL (Globe)—Good ore being developed in 14th level, the deepest in mine. Copper output for first half of 1916 was about 2,250,000 lb. Robert R. Boyd, superintendent.

INSPIRATION-NEEDLES (Miami) — Acquiring 11 more claims, making total acreage 720. Two churn drills now down about 400 ft. Two more drills expected last week in August. Ultimately seven drills will be employed.

Mohave County

HIDDEN TREASURE (Chloride)—Crosscut adit being driven. Grading for new compressor.

SCHUYLKILL (Chloride)—Unwatering resumed after delay due to boiler repairs.

MURDOCK (Oatman)—Reported work stopped on account of water. No. 9 Cameron pump to be installed.

BOUNDARY CONE (Oatman)—Vein cut on 750-ft. level. Assumed to be same vein as opened on the 550. F. W. Dryden, manager.

TOM REED (Oatman)—Still running 20 stamps on low-grade ore. Extensive development being carried on. Five shafts being sunk on east end of property.

WRIGLEY EXPLORATION (Oatman)—Contract to be let for driving 600 ft. of tunnel. A 75-hp. Fairbanks-Morse semi-Diesel engine and 12x14-in. Ingersoll-Rand compressor being installed.

UNITED EASTERN (Oatman)—Excavation for mill nearly completed. Change house, storehouse and machine shop recently completed. Shaft connections of main shaft completed to 650-ft. level.

OATMAN COMBINATION (Oatman)—Crosscutting on 500-ft. level. Some interesting developments expected as geological features are out of the ordinary for this district. Rhyolite dike, intruded through the andesite, encountered at bottom of shaft. Dike carries some gold, averaging about $2 and running as high as $3.50 per ton. Conditions at foot-wall contact expected to be interesting. Main vein lies in other direction near andesite-latite contact through which shaft passed at about 100-ft. level.

Yavapai County

LUCKY 5 MINING (Copper Basin)—Operations resumed under direction of A. M. Horton, president.

OCTAVE MINES CO. (Octave)—Development at eighth level disclosed oreshoot, 48 in. wide; last assay $12.13. H. E. Gibbs, president, 882 Drexel Bldg., Philadelphia, Penn.

LAST CHANCE (Walker)—Active operations at this gold property will begin by Sept. 1; new hoisting machinery, compressor and air drills being installed; plans to sink 250-ft. shaft at once; Benjamin Hayes, manager.

MILDRED GOLD MINING (Stanton)—Test shipment stoped from 85-ft. level and shipped to El Paso smelter netted $39.33 a ton, principally gold; good milling-grade and some shipping ore developed on 330-ft. level and upward; drainage and haulage tunnel being driven to tap incline shaft at vertical depth of 520 ft.; has 10-stamp mill with concentrating and amalgamation equipment.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Stoping on four levels from 2,700 to 3,100, most of the ore coming from 2,800; repairing shaft; sinking will soon begin. In mill 20 stamps dropping; 70 men employed.

PLYMOUTH CONSOLIDATED (Plymouth)—Installing new electric hoist in preparation for deeper development. Herringbone type of gear will be used. In July treated 10,900 tons yielding $57,300; working expense, $26.217; development, $7,214; surplus, $23,869. Other capital expended, $5,256.

Butte County

SOUTHERN CROSS (Enterprise)—Being developed by I. L. Rosenthal, of San Francisco. Flotation installation contemplated. Tube mill and other machinery will be driven by 40-hp. gasoline engine. Will install compressor and sink to 300 ft. A. E. Eagle, superintendent.

MOORETOWN AND LUMPKIN districts are active. Frank Borroughs is operating the Exposition mine, equipped with water power and 2-stamp prospecting mill; vein 18 in. wide, opened for 150 ft. Elisha Brooks installing wing dam and pump to operate new placer ground.

Eldorado County

BADGER HILL (Placerville)—Property optioned to Charles F. Bryant, John L. Woods and Otto J. Koch.

PYRAMID (Placerville)—Bonded to Oakland men who will deepen 500-ft. shaft to 1,300 ft.; new stations are being cut.

Inyo County

ESTELLE MINING CO. (Keeler)—Permitted to issue 9,700 shares at $10 per share.

DARWIN DEVELOPMENT (Darwin)—Flotation mill just installed will have try-out in August.

CUSTER (Darwin)—Two orebodies, recently opened, showing best ore ever produced by this mine.

CHRISTMAS GIFT (Darwin)—Skinner Bros. extracting good ore from this and from Lucky Jim mine.

CERRO GORDO (Keeler)—Shipments of zinc, silver and lead ores about 700 tons per month; 1,500 tons of slag per month from the old smeltery also being shipped.

BLUE MONSTER MINES CO. (Big Pine)—Lead-silver property, 43 mi. southeast of Big Pine, being developed under direction of Frederick Grundy. Has tunnel 104 ft. long. Recently shipped 500 tons.

OWEN'S VALLEY SALT CO. (Los Angeles)—Leasing corporation organized to operate the Saline Valley salt industry, which has a bucket tramway from the salt beds, in the valley, over the Inyo Range, to a point north of Keeler.

MINARET (Bishop) — John Beck, heading prospecting party for this company, sent to Bishop on pack trains 2 tons of ore said to run 176 oz. silver and 76% lead. Food supply for miners was hauled in by Alaskan dog teams. Company also has tungsten claims. L. V. Stevens, of San Francisco, has found tungsten about 4 mi. from Beck's camp.

TUNGSTEN MINES (Bishop)—New 300-ton mill expected to be ready by Aug. 10. Tramway surface track completed and several cars of ore hauled to the mill bin by mule. Gasoline motor will be ready for hauling ore by the time the mill is in operation. Connection between the lower tunnel and shaft of the Little Sister mine will soon be completed. Chris Lollischil injured, probably fatally, by fall of rock in Little Sister mine.

Kern County

WERINGER MINES CO. (Woody)—Col. A. P. Peake reports from Minneapolis sale of a large block of stock and expectation of resuming operation.

Nevada County

MANGANESE SHIPMENTS of 50 tons from deposit on Bear River will be hauled by teams to the narrow-gage railroad at Grass Valley. A. S. Henley, owner.

BRUNSWICK CONSOLIDATED (Grass Valley)—Below 1,200 level much new ore has recently been opened; 40 stamps dropping on good-grade ore.

TEXAS (Nevada City)—Recent satisfactory mill cleanup induced leasers to continue operation. Manager W. H. Tuttle secured control of several adjoining claims, which will be worked through the Texas shaft.

DELHI (Nevada City)—Bonded to Nevada City and Grass Valley men. Unwatering lower levels begun. Property equipped with complete plant including 20-stamp mill. Roy E. Tremoureux, assistant superintendent of the Champion mines, will be in charge.

Plumas County

ON SQUIRREL CREEK the "shooter system" of placer mining has been adopted by J. P. Dutre and Mason Maynard. The shooter system of intermittent hydraulicking was introduced in the region about Quincy several years ago and there are now six or seven hydraulic mines thus operated.

GRANITE BASIN (Quincy)—Double compartment shaft has reached 100-ft. point; disclosed vein 2 to 5 ft. wide, carrying good ore. Employ 20 men. Mill may be installed.

NEW YORK (Greenville)—This manganese property in North Cañon and others in Indian Valley are expecting to make shipments over the Indian Valley R.R. which is to be completed before heavy snows.

WALKER (Portola)—Reported shaft is 75 ft. in high-grade copper ore; face in new tunnel shows similar ore. Tramway from mine to flotation mill nearly completed. Control option reported taken by International Smelting Co. for $630,000. Smelting company is to do 500 ft. of drifting and sink shaft 200 ft. Orebody drilled to 356 ft. One crosscut in mine shows high-grade ore for 25 ft. and milling ore for 58 ft.

Shasta County

SHASTA NATIONAL COPPER CO. (Redding)—Authorized by corporation commission to sell 2,000,000 shares at par $1. Property adjoins Mammoth mine. Also permitted to issue 700,000 shares in payment for an option to purchase; this issue goes to William McEwen, M. P. Fries, C. F. Broullard, R. J. Shields and S. S. Norton.

Sierra County

SIERRA BUTTES (Sierra City)—Work resumed at this old producer. J. E. Westall, superintendent.

COLOMBO (Sierra City)—Crosscut in lower tunnel being run to intersect rich shoot found in upper workings. Emil Loeffler and associates, owners.

FROST (Downieville)—Being prospected by N. K. Cooper, of San Francisco, with view to installing machinery before winter.

COLORADO

Boulder County

COLD SPRING (Nederland)—Steady production of good-grade ore being made.

LITTLE TED (Eagle Rock)—Rich 6-in. vein of gold ore opened in west drift on 50-ft. level.

LINCOLN (Denver)—In sinking main shaft, 12-in. shoot of tungsten ore, assaying 10 to 15%, was opened at depth of 60 ft.; 2 ft. of low-grade ore also opened. Mine now belongs to recently organized Tungsten Chief Mining and Milling Co., of Denver.

Clear Creek County

ECLIPSE (Idaho Springs)—Mine in Maximilian Gulch will be reopened.

DIVES-PELICAN AND SEVEN THIRTY (Georgetown)—Rich silver oreshoot opened for over 50 ft. on Zero level.

Gunnison County

NEW TUNGSTEN DISCOVERIES made between Blistered Horn tunnel and head of Gold Creek, above Ohio City.

STAR (Gunnison)—Work resumed. Star and adjoining Bull Domingo in the Italian Mountain district were old lead producers.

Hinsdale County

CHAMPION (Lake City)—Shaft being unwatered for examination.

HOOSIER BOY (Capitol City)—New shafthouse and equipment completed. Shaft down 150 ft. where drifting is under way. Lead ore being sacked.

ALPS (Lake City)—This property on Alpine mountains reopened recently. Repairing tunnel and buildings preparatory to more extensive development.

COPPER BOY (Lake City)—This company recently organized by Denver men to operate group of over 30 claims in Burrows Park district. Old Tobasco mill and power plant purchased. Mill will be dismantled and moved.

Lake County

GEOLOGICAL SURVEY OF LACAWANA DISTRICT being made by Colorado State Geological Survey under direction of Prof. R. D. George, state geologist. This district, especially in Mt. Champion section, has a number of promising gold prospects.

PRINCE OF WALES LEASING CO. (Leadville)—Operations at Bartlett mine on Sugar Loaf resumed after completion of power line. Electric pump installed; winze will be sunk.

Ouray County

ATLAS (Sneffles)—Mine and mill being operated steadily.

BARSTOW (Red Mountain)—Mine and mill operated by lessees.

REVENUE (Sneffles)—Mine being reopened. Small force now at work.

Pitkin County

MIDNIGHT (Aspen)—Tunnel being driven to cut vein 1,300 ft. below present workings; tunnel now in 1,400 ft.

San Juan County

CONGRESS (Silverton)—Being developed by Pearson and associates under lease.

BONNER (Silverton)—This mine on middle fork of Mineral Creek under lease to Cunningham and Maxwell.

LEE MINING CO. (Eureka)—This company developing recently purchased Klondike under direction of R. L. E. Townsend.

NIAGARA (Silverton)—This property in Cunningham Gulch is being developed by the owner, T. A. Mix. A 4-ft. copper-lead vein opened on the Diamond.

STERLING (Silverton)—This property on Cement Creek recently purchased by Colorado Metals Co.; Louis Schafer, manager. Pocket of 40% tungsten ore opened on Sterling vein.

DORA (Silverton)—Three shifts sinking shaft on Dora vein to 100 ft. Levels No. 2 and No. 3 cleaned out; mill being repaired and remodeled. Tungsten ore opened in Level No. 2. W. R. Case, superintendent of mine; John Hughes in charge of mill.

Summit County

GOVERNOR (Breckenridge)—This old silver producer being reopened.

PENROSE (Breckenridge)—This placer property on upper Blue River being worked by lessees.

WELLINGTON MINES (Breckenridge)—Shipments of zinc concentrates resumed after curtailment due to strike in zinc-smelting plants.

Teller County

MARY McKINNEY (Cripple Creek)—Recent work on bottom level has opened good oreshoot in main vein.

GRANITE (Victor)—Crosscutting on 1,600-ft. level to open oreshoot found on the 1,400 level. Winze sunk 50 ft. below 1,400-ft. level produced some high-grade ore.

LITTLE MAY (Cripple Creek)—Gold ore assaying 0.5 oz. a ton has been opened by surface trenching on this property on Newton Hill—a part of a 25-acre tract owned by Cripple Creek General Mining and Extension Co. Company contemplates sinking a three-compartment shaft. Frank Vetter, manager.

C. O. D. (Cripple Creek)—Station cut on 800-ft. level preparatory to resumption of sinking operations. Will sink shaft an additional 500 ft. Machine-drilling equipment is to be installed. On 700-ft. level development is being done by Sun Tungsten Co., of Denver, under lease. E. J. Williams, superintendent.

JERRY JOHNSON (Cripple Creek)—Payable ore opened at breccia-schist contact, east of the shaft on the 750 ft. level of the main shaft on Ironclad Hill. Good ore also opened on 850-ft. level. The Cripple Creek Deep Leasing Co. plans to sink winze on vein and to crosscut from 950-ft. level over to the contact on which the ore has been found.

YELLOW BIRD GOLD MINING CO. (Cripple Creek)—Recent development on 200-ft. level of Red Bird shaft opened rich ore. Same shoot now being opened on the 400-ft. level, west heading. Crosscut east from shaft has cut a gold-bearing phonolite dyke which will be thoroughly prospected. Shaft, now 440 ft. deep, will be sunk to 700 ft.; three shifts will be employed sinking and work is to be completed in about 40 days. J. J. Yeckel, president and general manager.

IDAHO

Idaho County

BLACK PINE MINING AND MILLING CO. (Elk City)—Lower tunnel at 1,000 ft. encountered high-grade gold-silver ore.

BLACK DIAMOND (Dixie)—This company has a double-compartment shaft under way and has made arrangements for a 50-ton mill and other necessary buildings.

Shoshone County

HIGHLAND-SURPRISE (Beeler)—New mill now operating regularly, producing about 25 tons concentrates daily. Motor trucks used for 9-mi. haul to railroad.

BLACK HAWK (Kellogg)—William A. Beaudry, manager of Stewart Mining Co., is operating this property personally under three-year lease. Has completed 3,000-ft. tram to facilitate transport of 75 tons ore daily to Ontario mill.

STEWART MINING (Kellogg)—This company has acquired the entire $1,000,000 capital of Lone Mountain Silver-Lead Co. for an equal amount of its own stock at par. Recently increased its capital for purpose of buying other properties.

MICHIGAN

Iron

HOLMES (Ishpeming)—Shaft making good progress; will soon be bottomed. Headframe will be highest in district. Permanent buildings being erected and production should be started this winter.

YALE (Bessemer)—New shaft is to be sunk on Jackpot property, which adjoins. Ore will come from the Yale lands, under lease to Charcoal Iron Co. of America. Company has also lease on the Jackpot from the Jones & Laughlin Ore Co. Some equipment already ordered.

AURORA (Ironwood)—New shaft now well under way. It is inclined at 68° and is 11 ft. 4 in. by 20 ft. 8 in. in size. Will have steel sets, with concrete slabs in back; slabs are 6 and 8 in. in width by 3 in. thick. Plan to sink 100 ft. a month.

MISSOURI

Joplin District

MIHOMI (Cardin, Okla.)—Building mill on Cardin lease, south of Picher.

ROSE (Lincolnville, Kan.)—Reopened old Squaw mine. Sheet ground at 100 ft.

P. & J. (Joplin)—Kansas City men have leased silicate land at Saginaw, south of German-American.

NETTA (Picher, Okla.)—This big "ton-a-minute" mill, fourth Picher Lead Co. plant, has been started.

AMIA KENNETH (Baxter Springs, Kan.)—Starting shaft; drilling showed ore at two levels, 105 to 160 ft. and 198 to 214 ft.

THEURER & DIXON (Joplin)—Started 800-ton mill on old Bullfrog at Smelter Hill. Running on tailings now but are dewatering mine.

GIBSON (Joplin)—Handling 1,200 to 1,300 tubs of 1,200 lb. each per day at West Joplin. Enough ore raised in single shift to keep mill busy 24 hr.

SYMMES (Prosperity)—Excellent drill strike on eastern part of Dixie lease. Will start new shaft immediately and connect with mill by tram.

RED WASP (Aurora)—After trying six places, finally succeeded in getting water for milling from North Pole mine, one-half mile to the southwest.

CIRCLE (Oronogo)—Aërial tramway about completed from cave south of No. 9 shaft to Bunker Hill shaft. From the Bunker Hill, ore will be carried by surface railway to mill, about ¼ mi. Circle now getting ore from seven shafts.

MONTANA

Powell County

NATIONAL TUNGSTEN AND SILVER MINING CO. (Race Track)—New Boston company, headed by W. R. Brown, president, will develop group of tungsten properties. Must build 4-mi. wagon road, costing $4,000, before production can begin.

Silver Bow County

TUOLUMNE (Butte)—Raise from 2,600 to 2,400 level completed and winze being sunk on the vein from 2,600-ft. level. About 75 tons are mined daily, a good portion of this increase coming from the newly opened 2,600 level. At the east-side properties, retimbering of Sinbad shaft is completed to the 500-ft. level where mining will soon begin; some timbering yet to be done between 600 and 700 levels, Colusa-Leonard unwatered to 600 ft.; new headframe and hoist expected to be installed in 30 days.

NEVADA

Churchill County

NEVADA HILLS (Fairview)—June profit amounted to $8,738. In recent statement quick assets were given as $302,000 on July 1, of which $64,500 was cash. Because of drop in price of tungsten, company relinquished bond on property in Arizona.

Esmeralda County

REORGANIZED KEWANAS (Goldfield)—North drift from winze on 840-ft. level now out about 700 ft. on vein. Occasional streaks of good ore encountered.

GOLDFIELD CONSOLIDATED (Goldfield)—Second 500-ton unit of flotation completed and will be in operation Aug. 20. Regular operations suspended few days to facilitate change to new treatment.

JUMBO EXTENSION (Goldfield)—July profit was $28,400, of which $800 was from sale of dump ore. Mined 1,976 dry tons, gross value $72,500. Sampling, freight and treatment charges were $23,500. Smelting loss, $5,900. Operating expenses, $15,500.

Humboldt County

SEVEN TROUGHS MINING (Seven Troughs)—Retimbering 700-ft. incline shaft completed; drifting resumed; about 12 men employed.

SEVEN TROUGHS COALITION (Seven Troughs)—On July 31 in Bird winze at depth of 1,760 ft., water encountered flooding mine to 1,500-ft. level in three days. Pumps ordered, express shipment, and Pres. L. A. Freidman states mine will be unwatered in 30 days.

RAGGED TOP (Lovelock)—Wells bored at Toulon, on Southern Pacific R.R. about 10 mi. from mine, encountered water at 40 ft. Contract for 75-ton tungsten mill let to Stearns-Roger Manufacturing Co., of Denver. Shipments now hauled by caterpillar tractors 22 mi. to Miriam.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 12 was 8,960 tons valued at $187,360, compared with 9,662 tons for week previous. Producers were: Tonopah Belmont, 2,800 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,600; Jim Butler, 1,050; West End, 798; Rescue-Eula, 202; Halifax, 166; miscellaneous leases, 144 tons.

RESCUE-EULA (Tonopah)—No. 1 raise on vein from 950-ft. level up 170 ft. Winze from 950-ft. level sunk 100 ft.; crosscutting for vein.

GREAT WESTERN CONSOLIDATED (Tonopah)—Shaft repaired; additional pumps give total capacity 450 gal. per min. Water being rapidly lowered; will resume development about Sept. 1.

TONOPAH BELMONT (Tonopah)—Development at Desert Queen shaft resumed on 600-ft. level where east drift is being run to encounter 4-ft. vein of milling ore recently discovered near Jim Butler end line.

Storey County

ANDES (Virginia)—Saved 29 cars of ore on 350 level.

CONFIDENCE (Virginia)—Saved 45 cars low-grade ore on 200 level of Imperial shaft.

UNION CON. (Virginia)—Extracted 343 tons of ore: 164 tons averaging $23.74 and 132 tons $27.90 from 2,400 level; 47 tons averaging $12.41 from 2,500 level.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Overhauling of electric machinery continued. No work in Crown Point or Jacket account gas. Jacket mill received 840 tons dump rock and shipped bar bullion.

MEXICAN (Virginia)—South drift on 2,500 level shows porphyry and quartz at 94-ft. point; west crosscut advanced to 368-ft. point, face in porphyry and quartz. Mexican mill received 343 tons custom ore averaging $25.57 and 112 tons from dump averaging $9.99.

NEW MEXICO

Grant County

MERGING OF PINOS ALTOS MINES on the Pinos Altos side of the mountains is being discussed; would include Savannah Copper, now under lease to Wright & Stauber, the C. & O. Mining and Milling and the Silver Hill properties.

DAVIDSON COPPER (Fierro)—Leasers shipping 7% ore; mine nets owner $2,000 per month; 15 men employed.

OZARK SMELTING AND MINING (Magdalena)—Mill destroyed by fire Aug. 10. Several hundred men thrown out of work. Custom ore was treated as well as ore from company mines.

85 MINING CO. (Lordsburg)—Diesel engine repaired and running 24 days from date of explosion. Will ship about 12,000 tons in August. New 500-hp. Lyons-Atlas engine en route. A third Diesel may be installed as spare, or a 750-kv.-a. steam-turbine unit. A. J. Inderrieden, general manager.

TEXAS

SULPHUR EXPLORATIONS continue in the Pecos region, especially in Culberson and Reeves Counties, despite relinquishing of options by well-known mining interests. West Texas Sulphur Co. composed of New Orleans men, is preparing to exploit 600 acres in the Toyah district and the Michigan Sulphur and Oil Co. has installed near Orla a 6x30-ft. cylinder for extraction of the sulphur by steam; two additional retorts en route expected to give capacity of 20 to 30 tons daily. Grinding plant to be installed. Some local consumption, but these deposits are long distance from principal markets and at disadvantage regarding freight rates as compared with Gulf Coast producers.

UTAH

Beaver County

BEAVER COPPER (Milford)—Two-foot oreshoot opened at 73 ft. from shaft on 100-ft. level.

MAJESTIC (Milford)—This group shipped 18 cars in July. Old Hickory supplied 14 cars of low-grade copper ore and O.K. three cars of higher grade; Hoosier Boy shipped one car silver-lead ore.

Carbon County

KETCHUM COAL CO. property at Castle Gate is to be opened by Eccles estate of Ogden. Plan to build new haulage way and power plant, operating with electric power. New houses for employees, and a store will be built. The coal will probably be marketed in Ogden.

Iron County

NEW COAL DISCOVERY reported in Iron Springs Range, 22 mi. east of Lund and 15 mi. west of Parowan. Three seams of good quality traced for 4,000 ft. Adit gives 400 ft. of backs.

WASATCH OZOKERITE CO. (Soldiers Summit)—New mill now operating, producing 400 to 500 lb. per day of refined wax.

Juab County

TINTIC SHIPMENTS for week ended Aug. 11 amounted to 173 cars.

TINTIC STANDARD (Eureka)—New equipment to be installed and electric power used. Shipments being made.

IRON BLOSSOM (Silver City)—Winze in north end has reached 1,200-ft. level; drifting in search of copper ore, opened on levels above.

YANKEE (Eureka)—Lessees shipping lead and zinc ore from old workings. Company has three faces of ore exposed in the Humbug workings. Prospecting near Beck Tunnel for continuation of Beck Tunnel ore channel.

CHIEF CONSOLIDATED (Eureka)—Recently acquired ground at Homansville being opened. Shaft sinking being done under contract by Walter Fitch, Jr.; sank 256.3 ft. in 30 days; in porphyry for 150 ft., remainder limestone.

Salt Lake County

UTAH-APEX (Bingham)—Net earnings, quarter ended May 31, were $417,948 as compared to $202,719 in previous quarter. Cave-in occurring on 1,300 level, June 16, caused reduction of over 200 tons daily in shipments. New hoist to be installed at surface, and shaft raised to surface opening 650 ft. of unprospected ground. Ore will be hoisted, and then lowered to the Parvenu tunnel level (1,000-ft. level), and waste now carried off by railroad raised to surface. There is adequate dumping ground here, and a large saving will be effected. Experiments for recovery of zinc are soon expected to bring results.

WISCONSIN

Zinc-Lead District

WICKS (Linden)—The 50-ton Liverpool mill moved and rebuilt at Linden.

LAMPE (Highland)—Saxe Brothers and Lampe completed 100-ton mill on Lampe property.

VINEGAR HILL (Platteville)—New 150-ton mill started on Meloy lease north of Sally Waters mine, at New Diggings.

MINERAL POINT ZINC (Mineral Point)—New 200-ton mill completed on Kennedy tract at Highland. Has acquired Red Jacket mine and equipment at Centerville.

CANADA

Ontario

SYLVANITE (Kirkland Lake)—Will shortly resume.

HUDSON BAY (Cobalt)—A 2-in. vein carrying native silver found at surface.

SCHUMACHER—A 2-ft. vein showing free gold encountered in crosscut on 100-ft. level.

BEAVER (Cobalt)—Crosscutting in three directions on lower contact, so far without results.

DAVIDSON (Porcupine)—An 8-ft. vein, showing free gold, has been found southeast of the main workings.

DOMINION RAND (Temiskaming)—Shipments of copper ore being regularly made. Over 250,000 lb. shipped in few days.

THREE NATIONS (Porcupine)—Will be sold at public auction in South Porcupine in September to satisfy claim of $19,400.

EXCELSIOR (Porcupine)—Has defaulted in payments on Tommy Burns claims, which revert to Tommy Burns Gold Mines, Ltd.

LORRAIN CONSOLIDATED (South Lorrain)—Shaft now down 110-ft. is being sunk 200 ft. Drifting on 8-in. vein at 100-ft. level.

LA ROSE (Cobalt)—Work discontinued in tunnel under bluff on La Rose Extension property, as results were not encouraging.

LAKE SHORE (Kirkland Lake)—Installing new plant. Underground work will not be resumed until electric power from Cobalt reaches camp.

DOME (Porcupine)—July report shows production of $181,000, from the treatment of 38,150 tons, or $4.74 per ton; working cost, $2.61 per ton.

LITTLE NIPISSING (Cobalt)—Leased by Toronto and Detroit men from Peterson Lake company. Shaft will be dewatered. John W. Wilson in charge.

ADANAC (Cobalt)—Crosscut on 330-ft. level encountered high-grade ore previously developed on the 280. It is 3 in. wide. Sufficient high-grade ore has been blocked out to insure shipment at an early date.

TOUGH OAKES (Kirkland Lake)—During July approximately 3,700 tons of ore were treated; gross value $88,000, or $23.80 per ton. Oreshoot, 120 ft. long and of good grade, opened on 200-ft. level.

HOLLINGER CONSOLIDATED (Timmins)—Additional ball mill in operation, bringing capacity of mill up to 1,900 tons per day. Two 2,000-hp. transformers installed. Rich vein, rather narrow, found on the Millerton.

PERU

EXPORT OIL TAXES of 10% on crude petroleum and 20% on distillates are provided in a bill submitted to Congress by the Peruvian government. Tax is to be progressive, based on $8.40 per bbl. for Pennsylvania crude.

The Market Report

Metal Markets

NEW YORK—Aug. 23

All of the principal metals were strong and active during the last week, copper being especially a feature of strength. Lead and spelter both experienced smart advances, but toward the close lead was softer while spelter was distinctly reactionary.

Copper, Tin, Lead and Zinc

Copper—A very good business was done from day to day, largely in lots of quarter-million and half-million pounds, but there was a considerable sprinkling of big lots. The buying was chiefly by domestic manufacturers. It was significant that whereas for several weeks previously the buying had been by domestic manufacturers making munitions, last week it was to a very large extent by wire drawers. There were no sales reported as being specifically for export, but several purchases were believed to be destined to go abroad. The buying of last week was chiefly for November-December delivery. October copper is now very scarce and November copper is becoming so. There were some sales for October-December delivery, where the sellers threw in a little October copper. As in previous weeks it was distinctly a sellers' market. Buyers are turned away from one office and are directed to others to hunt for the best deliveries they can get. Prices vary according to time and competition is more a matter of time than it is of price. There was a little business done for delivery in 1917, but it did not amount to much. The total volume of transactions was probably a little less than in the previous week and was considerably exaggerated in reports in the daily papers. No further progress has yet been made in the negotiation of some large transactions that have been talked about.

The tightness in the copper market is primarily due to the deficiency of refining capacity, which the refiners do not appear to be able to increase. An interesting feature is the inability of copper manufacturers to get their scrap remelted, the furnaces of the refiners being taxed to the utmost in producing their own new copper.

Copper Sheets are 36½c. per lb., base price, for hot rolled, and 37½c. for cold rolled. Copper wire is 31@32c. per lb. at mill for large lots.

Copper Exports from Baltimore for the week included 2,237,870 lb. bars and plates to Archangel, Russia; 3,233,476 lb. bars and ingots and 190,376 lb. brass blanks to France; 448,975 lb. ingots to Denmark; 784,092 lb. bars to Liverpool.

Visible Supply of Copper in Europe on Aug. 15 was as follows: Great Britain, 3,179; France, 2,643; afloat from Chile, 1,450; afloat from Australia, 3,750; total, 11,022 long tons, or 24,689,280 lb. This is a decrease of 618 tons from the Aug. 1 report.

Tin—This market was featureless. Fluctuations in price during the week were practically nil.

Lead—The advance by the A. S. & R. Co. that was foreshadowed by the behavior of the market at the close of last week materialized on Aug. 17, when the price was raised to 6.25c. Independent producers immediately went higher and realized what they asked. On Aug. 18, the A. S. & R. Co. advanced its price to 6.50c., independent producers promptly going to 6¾c. and getting it. Prices varied according to delivery, the supply of early lead being very short. Some producers asked 6¾c. for August-September, but would sell October at 6½c. The A. S. & R. Co. adhered to its policy of selling only for shipment within 30 days, and its own supplies being short refused business from others than its regular customers. A fair volume of business was done by most of the producers during the early part of the week, but in the latter part the demand slackened and it seemed to be the tendency of the market to settle on the basis of 6.50c., New York.

Spelter—In the early part of the week some very large business for export was done in high-grade and high-grade intermediate spelter, about all of the producers of those kinds participating in this business, much of which was done with the British Government. The business of the week in Prime Western spelter, so far as reported, was only moderate, but this market appears to have been stirred up by some transactions associated with those for high-grade metal and the smart advance that was begun in the previous week was carried further. On Aug. 18 and 19, several hundred tons of Prime Western spelter, prompt delivery, were sold for export at 10@10¼c., New York basis, equivalent to about 9¾@10c., St. Louis. However, the bulk of the business on those days was for August-September delivery and was done at about 9@9¼c. At the close of the week the excitement had completely vanished and the market had become distinctly reactionary.

Zinc Sheets are in steady demand but with no change in quotations. The base price is $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
17	4.7575	66¼	25¾ @26¼	38¼	6.25 @6.35	6.10 @6.20	8.87½ @9.12½
18	4.7575	65¾	25¾ @26¼	38¼	6.50 @6.75	6.20 @6.40	9.00 @9.75
19	4.7575	65¾	26 @26¼	38¼	6.50 @6.75	6.30 @6.50	9.00 @10.00
21	4.7575	66	26¼ @26¾	38¼	6.50 @6.75	6.40 @6.50	9.00 @9.50
22	4.7575	66¼	26¼ @26¾	38¼	6.50 @6.70	6.40 @6.55	9.00 @9.50
23	4.7575	66¼	26¼ @27	38¼	6.50 @6.65	6.40 @6.50	8.75 @9.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Aug.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
17	31 1/16	114	111	126	26.77	171½	172¼	29¼	6.32	53	11.26
18	31 1/16	113	110	126	26.77	169¼	170¼	30	6.38	54	11.48
19	31 1/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	31 1/16	111	108½	127	26.99	169¼	170¼	30	6.38	55	11.69
22	31 1/16	110½	108	127	26.99	169	170	30	6.38	55	11.69
23	31¼	110	107½	127	26.99	169¼	170¼	30	6.38	55	11.69

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

Antimony—At the close last week this market stood at about 10c. for spot. The low level of prices attracted important buying orders, amounting to several hundred tons. Inquiry for a large additional quantity from ammunition makers caused the market to become greatly excited. Quotations jumped within a day or two to 15@16½c., without, however, business being done either at those or intermediate prices, excepting in small quantities. The excitement quickly disappeared and the price receded to 13½@14c., which we quote at the close. The principal interests refused to quote on futures.

Aluminum—Business has been fair with good demand. Deliveries on contract are easy. Quotations are 58@60c. per lb. for No. 1 ingots, New York.

Nickel—There is no change. The demand is strong and shipments are pressed. Quotations are unchanged at 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel is 5c. per lb. higher.

Quicksilver—Early in the week this market stood at $72. During the week there was a sharp advance to $75, on better demand and good sales. At the close we quote $75, New York. San Francisco reports by telegraph, $74, market unchanged.

Gold, Silver and Platinum

NEW YORK—Aug. 23

Gold—On Aug. 1, in order to avoid disclosing transfers of gold by sea from or to British possessions in time of war, the Bank of England ceased to announce daily receipts and withdrawals. The Bank return now shows daily only the total holdings at the close of the day:

The following Order in Council was promulgated in the "London Gazette" on July 28: "A person shall not melt down, break up, or use otherwise than as currency any current gold coin, and if any person acts in contravention of this regulation he shall be guilty of a summary offence against these regulations."

Silver—Owing to a decline in the demand for English Mint purchases silver price dropped to 31 5/16d. in London but the general tone of the market was good, and on the appearance of buying orders for India the price stiffened and closes steady at 31⅝d. in London. India has also again been buying silver in China for coinage shipments of some 2,500,000 ounces having been made from Shanghai to Bombay recently. China continues weak.

Owing to an error in types the price of silver in London on Aug. 12 was given last week at 31d. It should have been 31 11/16d. on that date.

Mexican dollars in New York were quoted Aug. 17 at 51¼@55¼c.; Aug. 18 at 51@55c.; Aug. 19 at 50⅝@54⅝c.; Aug. 21 at 50¾@54¾c.; Aug. 22 at 51@55c.; Aug. 23 at 51⅛@55⅛ cents.

Platinum—There was a much better demand for this metal. The two principal refiners both reported larger sales than for several weeks preceding. Business was done at $62.50@65, on which basis we quote the market at the close.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 19—Quotations are as follows: Base price for 2,000 lb. blende ore assaying 60% zinc, $70 for premium ore, $65@60 for medium, down to $55 for low grade. High price, $71.80; average for week's sales, $63.40. Calamine base price per 2,000 lb. assaying 40% zinc, $40@30. Average for week's sales, $33.85 per ton.

Lead base price per 2,000 lb. assaying 80% lead, $65@68; high price, $69.10; average realized for week's sales, $64 for all grades.

Shipments for week onded Aug. 19 were 4,457 tons blende, 259 tons calamine; for year to date, 213,845 tons blende, 17,426 tons calamine, 37,521 tons lead ore. Total value, $342,790 for the week; $25,292,280 for the year to date.

The excessive drought, prevailing for seven weeks, has forced several mines to close down, unable to obtain water for wet concentration of the ore. Other mines closed down on account of the stagnant condition of the market. The production, for a month under 5,000 tons is down to 4,500 tons per week. Mines that did not close down the past week reduced the working force to a minimum, further lowering the output. The advance of $5 per ton in the price of ores this week, with a decided enlivening of demand, while not indicated in this week's shipment, should show a substantial gain next week. It is having the effect of gradually lowering the stock in the bins.

Platteville, Wis., Aug. 19—Quotations of the district are according to the following figures: Base price per 2.000-lb. ton for material assaying 60% zinc is $56 por premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000 lb. ton is $60@64. Shipments for the week were: 3,004 tons of zinc ore, 38 tons of lead ore, and 690 tons of sulphur ore. For the year to date, the figures are: 76,727 tons of zinc ore, 2,787 tons of lead ore, and 17,471 tons of sulphur ore. Shipped during the week to separating plants, 4,372 tons of zinc ore.

OTHER ORES

Manganese Ore—The price of Brazilian ore continues about 40c. per unit at Rio de Janeiro. Freight rates are lower and the price at United States port is now 60@65c. per unit. Indian ore is 60c. per unit at tidewater. Some Virginia ore is said to have been sold at a lower price, but this is not confirmed.

Imports of manganese ore in the United States in June were 31,011 tons in 1915, and 58,143 in 1916; increase, 27,132 tons.

Imports at Baltimore for the week included 18,500 tons manganese ore from Brazil.

Antimony Ore—The position remained unchanged.

Tungsten Ore—Charles Hardy makes the following interesting report in his weekly circular: "More business in any time since April and May has been done during the past week. The foreign demand for tungsten ores is pressing and for very large quantities, France buying in the East and Russia in the West, the latter for shipment from San Francisco apparently to Vladivostok. The quantities that changed hands for these two foreign accounts run now close up to 500 tons, and the demand is still continuing. In order to relieve our market of the pressure of the accumulated stocks, some of the bigger holders were ready to shade their prices for round lots of 100 tons at a time, and the stocks in Pittsburgh alone, have been reduced by at least 200 tons. Now the bigger holders have advanced their price again to $20 and though no business has been done at this figure at the moment of writing, buyers have come close up to $20, and the negotiations are proceeding. An additional feature of interest is the fact that some of our home consumers, seeing the low prices and fearing that Europe will get all the benefit of present consumption a hundred tons changed hands. The position for tungsten has improved very considerably and though the stocks are still of fair size, at least 50% of the New York and Pittsburgh stocks ought to be cleared by now."

We quote the marketat $18@20 per unit.

Iron Trade Review

NEW YORK—Aug. 23

No great change is apparent in the general conditions of the market, either in amount of business or in the prices of material.

The American Iron and Steel Association reports the production of pig iron for the half-year ended June 30, 1916, at 19,619,522 gross tons, against 17,682,422 tons in the second half of 1915, and 12,233,791 tons in the first half of 1915. The figures show that the production in the first half of this year was 7,385,731 tons greater than in the corresponding period of last year. Details of the production are given on another page.

The United States Steel Corporation reports the total orders on its books July 31 at 9,593,592 gross tons, which is 46,866 tons less than on June 30, but 1,787.372 tons more than on Dec. 31, 1915. The total on July 31 has been exceeded only in April, May and June of this year.

Exports of Iron and Steel for June and for the fiscal year ended June 30 are reported as follows, the figures giving the gross tons of those articles which are reported by weight, the value of machinery and the total value of all iron and steel exports, including machines:

	June		Year	
	1915	1916	1914-15	1915-16
Gross tonnage...	356,829	527,542	2,003,798	4.862,154
Machinery, value	$10,266,981	$20,541,139	$93,863,694	$182,677,065
Total value.....	31,757,103	76,257,884	225,888,358	621,209,547

The total value of exports for the fiscal year was by far the largest ever reported, being more than double that for 1913, heretofore the record year.

Imports of those articles reported by weight were 31,610 tons in June, 1915, and 26,888 tons in June, 1916. For the fiscal year the tonnage was 251,251 in 1915, and 309,051 in 1916; an increase of 57,800 tons.

PITTSBURGH—Aug. 22

The steel market is slightly more active but is still decidedly quiet as compared with conditions that obtained prior to June. There is nothing that could possibly be called a "buying movement" in steel products. There is a wide divergence of view between seller and buyer. The stel mills are very confident of the future, and fully expect material to be scarce not only through this year but well into

next year. Among buyers there are some, such as automobile makers, who are anxious to be covered for the first half of 1917 irrespective of price while there are others who regard present prices as so high that their trade will be seriously curtailed when the lower-priced material is all used up. Among the jobbers the sentiment is, on the whole, decidedly unfavorable. The jobbers are not ready to take hold at present prices except in the most reserved fashion.

The mills point to their well-filled order books as evidence that they need have no concern. They are making no effort to press sales but are booking a fair tonnage, at least for a midsummer month. It is stated that they are accepting much less export business than is offered because they cannot make the deliveries.

The advance in plates and shapes started by the Carnegie Steel Co. is now in full force just as the advance in bars became generally effective a week or two ago. Bars and shapes are now 2.60c. and plates 3.00c., and thus specifications should be stimulated against contracts made during the past four months when prices were $2 a ton less.

So far as contract obligations are concerned, the mills are in much better position at this date than was expected, for they have passed through three dull months and still have almost as much business on their books as they had three months ago, enough, if equally distributed, to cover a run of about seven months, but as the contract tonnage is at higher prices it is not so certain that it will be fully specified.

Pig Iron—The market activity has increased further. There is more general buying of foundry and malleable grades, and the steel works are taking hold again. The Republic Iron and Steel Co. has bought 15,000 tons of bessemer and about 10,000 tons of basic for early delivery, while the Carbon Steel Co. has taken 10,000 tons of basic for delivery in the first half of 1917. A southern Ohio steel interest has taken 30,000 tons of basic for extended delivery. The business mentioned has just been closed, and follows the buying of 10,000 tons or more of basic by the American Steel Foundries. For months there have been predictions of a buying movement in pig iron which would result eventually in higher prices, possibly in even a sensational rise. Whether the present activity represents the beginning of an important movement it is too early to determine. Prices have not advanced, but a few furnaces have marked up their asking prices in anticipation. We quote: Bessemer, $21@21.50; basic, $19@18.25; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The scarcity of unfinished steel is unabated, but the pressure to buy steel has relaxed, either because buyers could not afford to pay higher prices or because they saw that raising their bids would not bring out steel. There is still some buying of shell steel and if this buying should cease the mills might find that they still have some soft steel to spare. We quote billets and sheet bars nominally at $45@50, with rods at $55@60 per ton.

FERROALLOYS

Ferrosilicon is somewhat firmer, the quotations for high-grade, 50% alloy, being $86@89 per ton at furnace, according to size of order. Bessemer ferrosilicon is from $31 for 10% up to $41 for 16%, per ton at furnace.

Spiegeleisen is firm and $40@45 per ton at purnace is quoted for 20% alloy, for high grade, 25 to 30% alloy, $55@65 per ton at furnace is asked.

Vanadium has caused a sensation this week through the announcement that all the stock of the American Vanadium Co., which practically controls most of the output and has built up a large business in the sale of the ore and metal and in the making of vanadium steel, has been sold to a syndicate of Philadelphia and New York capitalists for $7,000,000, which is $1,000 per share. The price is payable $650 in cash and $350 in notes or stock of the new company which is to be organized. The old company is owned in Philadelphia and Pittsburgh and has $700,000 stock. The new company, which will retain the name of the old, will have a capital of $13,500,000, made up of $5,000,000 of 7% preferred stock, $6,000,000 of common, and $2,500,000 of 6% short-term notes. At the head of the syndicate which takes over the company are J. L. Replogle and Kuhn, Loeb & Co. With them are associated Cassatt & Co., of Philadelphia, Chandler Bros. & Co., Harrison Williams, and half a dozen others. Mr. Replogle, now vice-president and general manager of the company, will be made president after the conclusion of the sale. James J. Flannery, head of the present company, will become chairman of the board.

Ferromanganese—The market is very quiet. Spot is obtainable usually at the contract price of $175. Rumors that the English makers are withdrawing the contract price are not substantiated and both English and domestic is quotable at $175 on contract.

IRON ORE

Shipments of Lake Superior iron ore in July were 9,750,157 gross tons. For the season to Aug. 1 the total shipments were, in gross tons, as reported by the "Iron Trade Review":

Port.	1915	1916	Changes
Escanaba	2,062,700	3,647,192	I. 1,584,492
Marquette	1,114,360	1,834,919	I. 720,559
Ashland	1,870,077	3,506,945	I. 1,636,868
Superior	3,064,002	5,865,546	I. 2,801,544
Duluth	6,710,460	9,338,482	I. 2,628,022
Two Harbors	3,903,704	5,172,640	I. 1,268,936
Total	18,725,303	29,365,724	I.10,640,421

Of the July shipments 7,681,084 tons, or 78.8% of the total, went to Lake Erie ports. At those ports the total ore on dock Aug. 1 was 4,810,671 tons, compared with 6,539,933 tons on Aug. 1, 1915. Shipments from lower lake ports to furnaces during the month amounted to 5,289,590 tons.

Receipts at South Chicago during July were 1,097,484 tons and at Gary, Ind., 312,773 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 403,340 net tons; shipments, 401,577 tons. Shipments of Greensburg and Upper Connellsville districts, 37,666 tons.

Connellsville—Coke is still very scarce and commands $2.75@2.85 for spot furnace, in the limited buying, chiefly by brokers. There is no interest in contract coke. Foundry is $3.25@3.50 for either spot or contract.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, seven months ended July 31, in short tons:

	1915	1916	Changes
Anthracite	6,068,036	6,766,550	I. 698,514
Bituminous	23,855,500	28,283,849	I. 4,428,349
Coke	6,088,195	8,508,352	I. 2,420,157
Totals	36,011,731	43,558,751	I. 7,547,020

The total increase this year was 21%; the largest proportional gain being in coke. The total tonnage for the month of July was 6,077,780, an increase of 663,270 tons, or 12.3% over July of last year.

Chemicals

NEW YORK—Aug. 23

The general market shows rather a stronger tone. There is less resale material offering and heavy chemicals are generally firmer. It may be said that trade is unusually good for this season of the year.

Arsenic—Most of the business now forward is on contracts. Deliveries are steady, but stocks are not large. Outside demand is only moderate. Quotations are $6@6.50 per 100 lb. for spot.

Copper Sulphate—Demand is not heavy and sales have been moderate. There has been no material change. Quotations are $8@10 per 100 lb., according to grade, quantity and terms of order.

Nitrate of Soda—Increased production is reported from Chile. Further arrivals here are noted, although tonnage is still scarce and hard to get. Current demand is easier, and there is no pressure to buy. Sales have been made at $3 per 100 lb. for spot, and this might be shaded a little for futures.

Sulphur—Demand continues good and there are some large inquiries. Spot material is rather scarce and commands $35 per gross ton. Futures can be had at $30 per ton, New York delivery.

Sulphuric Acid—Spot business is a little easier, but makers are selling freely for future delivery. For 60-deg. acid $20 per ton is had for spot material. For 66-deg. acid $30 per ton is quoted.

PETROLEUM

Production of petroleum in California in July is reported at 8,010,183 bbl.; shipments, 8,076,244 bbl.; stocks on July 31 were 51,133,949 bbl. There were 58 new wells, with a total daily production of 9,360 bbl., completed in July.

The U. S. Geological Survey in a recent monograph estimates the total petroleum production of the world in 1915 at 426,892,673 bbl., or 57,298,786 metric tons; an increase of 28,194,397 bbl., or 7%, over 1914. This is believed to be the largest output ever recorded. The United States furnished 65.9% of the total, Russia 16.1% and Mexico 7.7%. The five larger producers were the United States, 37,480,547 metric tons; Russia, 9,353,077; Mexico, 4,388,068; the Dutch East Indies, 1,710,445; Rumania, 1,673,145 tons. Other countries supplied only 5.7% of the total.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	.....	$1.00
Alta Silver, Nev.	Sept. 1	Sept. 25	0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Belmont, Ida.	Aug. 9	Aug. 26	0.006
Blue Star, Ida.	Sept. 25	Oct. 21	0.02
Cash Boy, Nev.	Sept. 1	Oct. 16	0.01
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Clear Grit, Ida.	Aug. 7	Aug. 25	0.002
Coal Creek, Ida.	Aug. 25	Sept. 26	0.005
Exchequer, Nev.	Sept. 5	Sept. 23	0.03
Emerald, Utah.	Aug. 15	Sept. 9	0.00½
Friend, Ida.	Aug. 26	Sept. 16	0.002
Four Timbers, Ida.	July 26	Aug. 26	0.002
Great Bend, Nev.	Aug. 15	Sept. 20	0.01
Hector, Ida.	Aug. 7	Sept. 15	0.005
Hugo, Ida.	July 29	Aug. 30	0.002
Jacket-C.Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Jack Waite, Ida.	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0.01
Keweenaw, Mich.	Sept. 2	.....	1.00
Lehi Tintic, Utah.	Aug. 5	Aug. 25	0.0025
Lucky Calumet, Ida.	July 20	Aug. 21	0.005
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0.003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	Sept. 9	Oct. 7	0.002
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Paloma, Utah.	Aug. 21	Sept. 9	0.01
Phedora, Ida.	Aug. 29	Sept. 29	0.001
Rico Argentine, Colo.	Aug. 17	Sept. 2	0.01
Rio Grande Grubstake, Nev.	June 22	Aug. 31	0.002
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0.01
Sixes, Nev.	Aug. 23	Sept. 8	0.10
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15	.....	0.05
Sunrise, Ida.	July 27	Aug. 28	0.002
Sunset, Ida.	Aug. 5	Aug. 26	0.0015
Tar Baby, Utah.	Aug. 3	Sept. 4	0.01
Tyler, Ida.	Sept. 12	Oct. 12	0.0015
Utah, United, Utah	Aug. 12	Aug. 30	0.01
Whale, Utah.	Sept. 5	Sept. 25	0.05
Wolf Mt. Copper, Utah.	Aug. 2	Sept. 6	0.005
Wonderful, Ida.	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Aug. 23	
Name of Comp.	Bid.
Alta	$.03
Andes	.08
Best & Belcher	.05
Bullion	.01
Caledonia	.40
Challenge Con.	.08
Confidence	.18
Cons. Imperial	.01
Con. Virginia	.10
Gould & Curry	.03
Hale & Norcross	.06
Jacket-Cr. Pt.	.06
Mexican	.17
Occidental	$.70
Ophir	.20
Overman	$.04
Savage	.05
Seg Belcher	$.02
Sierra Nevada	.25
Union Con.	.68
Utah Con.	.01
Belmont	4.05
Jim Butler	.84
MacNamara	.05
Midway	.19
Mont.-Tonopah	$.23
North Star	.15
Rescue Eula	.23
West End Con.	.80
Atlanta	.09
Blue Bell	$.01
Booth	.12
C.O.D. Con	.02
Comb. Frac	.06
D'field B.B.	$.03
D'field Daisy	.03
Jumbo Extension	.53
Pitts.-Silver Peak	$.12
Round Mountain	.41
Sandstorm Kendall	$.04
Silver Pick	.15
Central Eureka	$.09
Argo	$.10
Ariz. Central	$.10
Big Jim	.86
Lazy Boy	$.12
Oatman No. Star	$.10
Tom Reed	$1.55
United Eastern	$3.62½
United Western	$.08

LONDON Aug. 11	
Alaska Tre'dwell	£5 15s 0d
Burma Corp.	3 3 9
Cam & Motor	0 12 6
Camp Bird	0 8 9
El Oro	0 9 0
Esperanza	0 11 6
Mexico Mines	3 12 6
Nechi, pfd.	0 13 0
Oroville	0 17 0
Santa Gert'dis.	0 13 0
Tomboy	1 2 6

SALT LAKE Aug. 22	
Name of Comp.	Bid.
Alta Con.	$.21½
Black Jack	.10
Colorado Mining	.16
Crown Point	.03½
Daly-Judge	7.75
Emma Cop.	$.54
Gold Chain	.20
Grand Central	.65
Iron Blossom	1.52½
Lower Mammoth	.03
May Day	.10
Opohongo	$.01½
Prince Con.	1.50
Seven Troughs	$.03½
Silver King Coal'n	2.90
Silver King Con.	3.25
Sioux Con.	.09
Uncle Sam	.05
Yankee	.17

COLO. SPRINGS Aug. 23	
Acacia	$.03½
Doctor Jack Pot	.10½
Elkton Con.	.15½
El Paso	.60
Findlay	.03½
Gold Sovereign	.05½
Golden Cycle	2.50
Granite	.62
Isabella	.18½
Jack Pot	.06
Jerry Johnson	$.03½
Mary McKinney	.25
Portland	1.65½
Vindicator	1.75

TORONTO Aug. 23	
Adanac	$.75
Bailey	.07½
Chambers Ferland	.18
Coniagas	4.75
La Rose	.62
Peterson Lake	.22
Right of Way	.05½
Seneca Superior	.25
T. & Hudson Bay	$55.00
Temiskaming	.58
Trethewey	$.21
Wettlaufer-Lor.	.13
Dome Exten.	.35
Dome Lake	.42
Foley O'Brien	.50
Hollinger	27.90
Jupiter	.26
McIntyre	1.31
Newray	.50
Porcu. Crown	.63
Preston E. D.	$.03
Vipond	.39
West Dome	.37

N. Y. EXCH. Aug. 23	
Name of Comp.	Clg.
Alaska Gold M.	16½
Alaska Juneau	7½
Am.Sm.&Ref.,com	100½
Am. Sm. & Ref., pf.	111½
Am. Sm. Sec., pf. A	‡93
Am. Sm. Sec., pf. B.	85
Am. Zinc	33½
Am. Zinc, pf.	‡65
Anaconda	86½
Batopilas Min.	‡1½
Bethlehem Steel	480
Bethlehem Steel, pf.	‡125
Butte & Superior	68
Chile Cop.	19½
Chino	51½
Colo. Fuel & Iron	50½
Crucible Steel	77½
Dome Mines	‡25½
Federal M. & S.	‡13
Federal M. & S., pf.	‡35½
Great Nor., ore ctf.	40½
Greene Cananea	45½
Homestake	‡130
Inspiration Con.	52½
International Nickel	42
Kennecott	40½
Lackawanna Steel	78
Miami Copper	34½
Nat'l Lead, com.	66½
National Lead, pf.	‡112½
Nev. Consol.	18½
Ontario Min.	6½
Quicksilver	‡2½
Quicksilver, pf.	‡4½
Ray Con.	24½
Republic I&S, com.	54½
Republic I&S, pf.	113½
Sloss-Sheffield	50
Tennessee Copper	25½
Utah Copper	83
U. S. Steel, com.	97½
U. S. Steel, pf.	118
Va. Iron C. & C.	42½

N. Y. CURB Aug. 23	
Beaver Con.	.38
Buffalo Mines	.85
Butte & N. Y.	2
Butte C. & Z.	5½
Caledonia	66
Can. Cop. Corpn.	1½
Cashboy	.04½
Cerro de Pasco	36
Con. Ariz. Sm.	1 7/16
Con. Coppermines	‡1 1/16
Con. Nev.-Utah	‡ 5/16
Crystal Cop.	1 1/16
First Nat. Cop.	4½
Florence	‡.75
Goldfield Con.	.82
Goldfield Merger	.08½
Granite	‡.20
Hecla Min.	5 3/16
Howe Sound	4½
Jerome Verde	1 5/16
Joplin Ore & Spel.	‡.45
Kerr Lake	4 1/16
Magma	‡15
Majestic	‡ 1/16
McKinley-Dar-Sa.	.59
Mother Lode	.32
Nevada Hills	‡.15
N. Y. & Hond.	15
Nipissing Mines	7½
Oro	‡.04
Ray Hercules	3½
Rochester Mines	61
St. Joseph Lead	15½
Standard S. L.	1½
Stewart	‡.25
Success	.33
Tonopah	5 1/16
Tonopah Ex.	5 1/16
Tribullion	‡ 1/16
United Zinc	‡6
White Knob, pf.	‡1½
White Oaks	6
Yukon Gold	‡2 1/16

BOSTON EXCH Aug. 23	
Name of Comp.	Bid
Adventure	3½
Ahmeek	100½
Algomah	1½
Allouez	67
Ariz. Com., ctfs.	9
Bonanza	.25
Butte-Balaklava	1 1/16
Calumet & Ariz.	71½
Calumet & Hecla	559
Centennial	16
Copper Range	64
Daly West	2
East Butte	13½
Franklin	8
Granby	87½
Hancock	13½
Helvetia	‡.25
Indiana	3½
Island Cr'k, com.	46½
Island Cr'k, pfd.	88½
Isle Royale	28½
Keweenaw	3½
Lake	13
La Salle	4
Mason Valley	2
Mass	12½
Mayflower	3
Michigan	3½
Mohawk	90½
New Arcadian	6
New Idria	12
North Butte	23½
North Lake	1
Ojibway	‡1½
Old Colony	1½
Old Dominion	70½
Osceola	89
Quincy	92
St. Mary's M. L.	75
Santa Fe	2
Shannon	8½
Shattuck-Ariz.	29½
So. Lake	7
So. Utah	.22
Superior	16½
Superior & Bost.	4 1/16
Tamarack	45
Trinity	6½
Tuolumne	.45
U. S. Smelting	71½
U. S. Smelt'g, pf.	50½
Utah Apex	4
Utah Con.	14
Utah Metal	8
Victoria	3½
Winona	5½
Wolverine	53
Wyandot	1½

BOSTON CURB Aug. 23	
Bingham Mines	10
Boston Ely	1½
Boston & Mont.	.83
Butte & Lon'n Dev.	.69
Calaveras	5½
Calumet-Corbin	.04
Chief Con.	2
Cortez	.25
Crown Reserve	.35
Davis-Daly	2½
Eagle & Blue Bell	1½
Houghton Copper	1½
Iron Cap Cop., pf.	5½
Mexican Metals	.39
Mines of America	‡2½
Mojave Tungsten	3½
Nat. Zinc & Lead	76
Nevada-Douglas	1½
New Baltic	1½
New Cornelia	14½
Ohio Copper	.09
Oneco	.80
Raven Copper	‡.05
Rex Cons.	.20
Rilla	.16
United Verde Ext.	33½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	.....	25.979	22.780	.....
September	53.290	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	85.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	.....	151.440	.....
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	.....	4.520	.....	21.946	.....
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.27	.....
December	5.355	.....	5.266	.....	28.80	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported,

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	.....	15.31	.....	14.75	.....
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17 57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.